SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

ESTD 2001

ISO 9001 REGISTERED

REGULATIONS, CURRICULA & SYLLABI

PG (M.E. and M.B.A.)

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2021

(Revised)

SENGUNTHAR
Shrine 2 Success

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

REGULATIONS, CURRICULA & SYLLABI

PG (M.E. and M.B.A.)

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2021

(Revised)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

INDEX

REGULATIONS-2021

PG (M.E.)

SENGUNTHAR
Shrine 2 Success

REGULATIONS-2021

PG (M.B.A.)

SENGUNTHAR
Shrine 2 Success

SCHEME FOR CURRICULUM

M.E. - Computer Science Engineering

SENGUNTHAR
Shrine 2 Success

SCHEME FOR CURRICULUM

M.E. - Structural Engineering

SENGUNTHAR
Shrine 2 Success

SCHEME FOR CURRICULUM

M.E. – VLSI Design

SENGUNTHAR
Shrine 2 Success

SCHEME FOR CURRICULUM

M.B.A

SENGUNTHAR
Shrine 2 Success

SCHEME FOR SYLLABI

M.E. - Computer Science Engineering

SENGUNTHAR
Shrine 2 Success

SCHEME FOR SYLLABI

M.E. - Structural Engineering

SENGUNTHAR
Shrine 2 Success

SCHEME FOR SYLLABI

M.E. – VLSI Design

SENGUNTHAR
Shrine 2 Success

SCHEME FOR SYLLABI

M.B.A

SENGUNTHAR
Shrine 2 Success

SCHEME FOR EEC

List of Courses

SENGUNTHAR
Shrine 2 Success

SCHEME

Credit Summary

SENGUNTHAR
Shrine 2 Success

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
Recognized Under Section 2(f) & 12(B) of the UGC Act, 1956
NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

PG (M.E. and M.B.A.) REGULATIONS - 2021

(CHOICE BASED CREDIT SYSTEM)

Note: The regulations hereunder are subject to amendments as may be decided by the Academic Council of the Sengunthar Engineering College from time to time. Any or all such amendments will be effective from such date and to such batches of candidates (including those already undergoing the program) as may be decided by the Academic Council.

SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
TIRUCHENGODE – 637205, Namakkal District

PG (M.E.) REGULATIONS 2021

CHOICE BASED CREDIT SYSTEM

(For M.E. - Computer Science and Engineering, Structural Engineering and VLSI Design)

The following Regulations are applicable to the students admitted to M.E. Programmes from the academic year 2021 - 2022.

1. DEFINITIONS

In these Regulations, unless the context otherwise requires:

i. "**University**" means ANNA UNIVERSITY, CHENNAI.

ii. "**College"** means SENGUNTHAR ENGINEERING COLLEGE.

iii. "**Programme**" means Post Graduate Degree Programme e.g. M.E. Degree Programme.

iv. "**Branch**" means specialization or discipline of M.E. Degree Programme like "Structural Engineering", "VLSI Design", etc.

v. "**Course**" means Theory or Practical subject that is normally studied in a semester, like Applied Mathematics, Advanced Data Structures, etc.

vi. "**Credit**" means a numerical value allocated to each course to describe the candidate's workload required per week.

vii. "**Grade**" means the letter grade assigned to each course based on the marks range specified.

viii. "**Grade Point**" means a numerical value (0 to 10) allocated based on the grade assigned to each course.

ix. "**Head of the Institution**" means Principal of the College and also the Chairman, Academic Council of the College.

x. **"Controller of Examinations"** means the Authorized person who is responsible for all examinations of the College .

xi. **"Head of the Department"** means Head of the Department of the Programme Concerned.

2. ADMISSION PROCEDURE

Candidates for admission to the first semester of the M.E. Programme shall be required to have passed an appropriate qualifying Degree Examination of Anna University or any examination of any other University or authority accepted by the Syndicate of Anna University, Chennai as equivalent thereto.

Eligibility conditions for admission such as the Eligible UG Degree, marks, class obtained the number of attempts in the qualifying examination and physical fitness will be as prescribed by the Syndicate of the Anna University from time to time.

3. PROGRAMMES OFFERED

1. M.E. - Computer Science &Engineering
2. M.E. - Structural Engineering
3. M.E. - VLSI Design

3.1 MODES OF STUDY

3.1.1 Full-Time

Candidates admitted under 'Full-Time' should be available in the College / Institution during the entire duration of working hours (From Morning to Evening on Full-Time basis) for the curricular, co-curricular and extra-curricular activities assigned to them.

The Full-Time candidates should not attend any other Full-Time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or Company during the period of the Full-Time programme. Violation of the above rules will result in cancellation of admission to the PG programme.

4. STRUCTURE OF THE PROGRAMMES

4.1 Categorization of Courses

Every Post Graduate Degree Programme shall have a curriculum with syllabi consisting of theory and practical courses in each semester that have been approved by the respective Board of Studies and Academic Council of the College.
The courses shall be categorized as follows:

i. **Foundation Courses (FC)** includes Mathematics, Research Methodology and IPR.
ii. **Professional Core (PC)** courses include the core courses relevant to the chosen Specialization / branch.
iii. **Professional Elective (PE)** courses include the elective courses relevant to the chosen Specialization / branch.
iv. **Open Electives (OE)** courses include the courses relevant to the chosen or other Specialization / Programme which a student can choose from the elective courses offered

by the other departments. However, the open elective courses offering are subject to availability of minimum class strength specified from time to time.

v. **Employability Enhancement Courses (EEC)** includes Research Paper Writing, Seminar, Projects (Mini Project, Project Work Phase - I and Project Work Phase – II), Internship, Summer Project, Case Study and Industrial / Practical Training.

4.2 **Courses per Semester**

Curriculum of a semester shall normally have a blend of Theory / Lab Embedded Theory / Theory with lab Component / Employability Enhancement Courses. Each course may have credits assigned as per clause 4.3

4.3 Credit Assignment

S. No.	Name of the Programme	Minimum Credits to be Earned
1	M.E. Computer Science and Engineering	70
2	M.E. Structural Engineering	70
3	M.E. VLSI Design	70

Each course is assigned certain number of credits based on the following:

Contact Period Per Week	Credits
1 Lecture Period	1
1 Tutorial Period	1
2 Practical Periods (Laboratory / Seminar / Project Work / etc.)	1

4.4 Project Work

4.4.1 The project work for M.E.Programmes consists of Mini Project, Phase – I and Phase – II. The Mini Project is to be undertaken during II semester, Phase – I is to be undertaken during III semester and Phase – II, which is a continuation of Phase – I is to be undertaken during IV semester.

4.4.2 In case of candidates of M.E.Programmes not completing Phase - I of project work successfully, the candidates can undertake Phase - I again in the subsequent semester. In such cases the candidates can enroll for Phase - II, only after successful completion of Phase – I.

4.4.3 Project work shall be carried out under the supervision of a “qualified teacher” in the Department concerned. In this context “qualified teacher” means the faculty member

possessing (i) PG degree with a minimum of 3 years' experience in teaching or (ii) Ph.D. degree.

4.4.4 A candidate may, however, in certain cases, be permitted to work on projects in an Industrial/Research Organization, on the recommendations of the Head of the Department Concerned. In such cases, the Project work shall be jointly supervised by a supervisor of the department and an expert, as a joint supervisor from the organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.

4.4.5 The Project work (Phase II) shall be pursued for a minimum of 16 weeks during the final semester.

4.4.6 The deadline for submission of final Project Report is 60 calendar days from the last working day of the semester in which project / thesis / dissertation is done. However, the Phase-I of the Project work in M.E. Programmes shall be submitted within a maximum period of 30 calendar days from the last working day of the semester as per the academic calendar published by the college.

4.5 Industrial Training / Internship

The students may undergo industrial training for a period as specified in the curriculum during summer / winter vacation. In this case, the training has to be undergone continuously for the entire period.

The students may undergo internship at research organization after due approval from the Head of the Department for the period prescribed in the curriculum during summer / winter vacation, in lieu of Industrial training.

If Industrial training / Internship is not prescribed in the curriculum, the student may undergo Industrial Training / Internship optionally.

4.6 Value Added Courses

The Students may optionally undergo Value Added Courses and the credits earned through the Value Added Courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. One / Two credit courses shall be offered by a department of an institution with the prior approval from the Head of the Institution. The details of the syllabus, time table and faculty may be sent to the Controller of Examinations after approval from the Head of the Institution concerned at least one month before the course is offered. Students can take a maximum of two one credit courses / one two credit course during the entire duration of the Programme.

4.7 Online Courses

4.7.1 Students may be permitted to credit only one online course of 3 credits with the approval of Head of the Institution and Board of Studies concerned.

4.7.2 Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Board of Studies concerned from time to time. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Controller of Examinations. The details regarding online courses taken up by students should be sent to the Controller of Examinations, one month before the commencement of end Semester Examination.

4.8 Medium of Instruction

The medium of instruction is English for all courses, examinations, seminar presentations and project / thesis / dissertation reports.

5. DURATION OF THE PROGRAMMES

5.1 The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.E.	4	8

5.2 The Curriculum and Syllabi of all the P.G. Programmes shall be approved by the Academic Council. The number of Credits to be earned for the successful completion of the programme shall be as specified in the Curriculum of the respective specialization of the P.G. Programme.

5.3 Each semester shall normally consist of 80 working days or 560 periods of each 50 minutes duration. The Head of the Institution shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught. For the purpose of calculation of attendance requirement for writing the end semester examinations by students, following method shall be used.

$$\text{Percentage of Attendance} = \frac{A}{B} \times 100$$

A -- Total No. of periods attended in all the courses per semester

B -- Total No. of periods taken together for all courses of the semester

End Semester Examinations conducted by the College will be scheduled after the last working day of the semester.

6. COURSE REGISTRATION

6.1 The Institution is responsible for registering the courses that each student is proposing to undergo in the ensuing semester. Each student has to register for all courses to be undergone in the curriculum of a particular semester. The student can also register for courses for which the student has failed in the earlier semesters. In such cases the student shall do reappearance registration for those courses for which the attendance requirement is not compulsory. However, the student has the option to take up some other professional elective or open elective that he has failed to pass. But, the total number of credits that a student is allowed to register per semester cannot exceed 41. The registration details of the candidates may be approved by the Head of the Institution and forwarded to the Controller of Examinations. This registration is for undergoing the course as well as for writing the End Semester Examinations. No Elective course shall be offered by any department unless a minimum 5 students register for the course. However, if the students admitted in the associated Branch and Semester is less than 5, this minimum will not be applicable.

If the student has failed in Lab Embedded Theory Course, the student has to register for both the Theory and Practical Exams.

If the student is absent for any one of the Lab Embedded Theory exams ie. Theory or Practical, the student has to register for both the Theory and Practical Exams.

The courses that a student registers in a particular semester may include

i. Courses of the current semester.
ii. The core (Theory/Lab /EEC) courses that the student has not cleared in the previous semesters.
iii. Elective courses which the student failed

7. EVALUATION OF PROJECT WORK

The evaluation of Project Work for Phase-I & Phase-II of M.E. shall be done independently in the respective semesters and marks shall be allotted as per the weightages given in Clause 7.1.

7.1 There shall be three assessments (each 100 marks) during the Semester by a review committee. The Student shall make presentation on the progress made before the Committee. The Head of the Institution shall constitute the review committee for each branch of study. The total marks obtained in the three assessments shall be reduced to 40 marks and rounded to the nearest integer (as per the Table given below). There will be a viva-voce Examination during End Semester Examinations conducted by a Committee consisting of the supervisor, one internal examiner and one external examiner. The internal examiner and the external examiner shall be appointed by the Controller of Examination. The distribution of marks for the internal assessment and End semester examination is given below:

Internal Assessment (40 Marks)			End Semester Examination (60 Marks)			
Review I	Review II	Review III	Thesis Submission (20 Marks)	Viva – Voce (Rounded to 40 Marks)		
10	15	15	External Examiner	Internal Examiner	External Examiner	Supervisor Examiner
			20	15	15	10

7.2 The Project Report prepared according to approved guidelines as given by Board of Studies and duly signed by the supervisor(s) and the Head of the Department concerned shall be submitted to the Head of the Institution.

7.3 If the candidate fails to obtain 50% of the internal assessment marks in the Phase – I and Phase – II of final project, the candidate will not be permitted to submit the report for that particular semester and has to re-enroll for the same in the subsequent semester.

If a candidate fails to submit the project report on or before the specified deadline, the candidate is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester. This applies to both Phase – I and Phase – II in Project Work.

If a candidate fails in the end semester examinations of Phase – I, the candidate has to resubmit the Project Report within 30 days from the date of declaration of the results. If the candidate fails in the End semester examination of Phase – II of Project work of M.E, the candidate shall resubmit the Project Report within 60 days from the date of declaration of the results.

The resubmission of a project report and subsequent viva-voce examination will be considered as reappearance with payment of exam fee. For this purpose, the same Internal and External examiners shall evaluate the resubmitted report.

7.3.1 A copy of the approved Project Report after the successful completion of viva-voce examinations shall be kept in the library of the college /institution.

7.3.2 Practical / Industrial Training, Summer Project if specified in the Curriculum shall not exceed the maximum duration of 4 weeks and should be organized by the Head of the Department for every student.

7.3.3 At the end of Practical / Industrial Training, Summer Project the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation for 100 marks will be carried out internally based on this report

and a Viva-Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Institution. Certificates submitted by the students shall be attached to the mark list sent by the Head of the Department to the Controller of Examination.

8. CLASS ADVISOR

There shall be a class advisor for each class. The class advisor will be one among the (course-instructors) of the class. He / She will be appointed by the Head of the department concerned. The Class advisor is the Convener of the class committee. The responsibilities for the class advisor shall be:

- To act as the channel of communication between the Head of the Department and the students of the respective class.
- To collect and maintain various statistical details of students.
- To help the chairperson of the class committee in planning and conduct of the class committee meetings.
- To monitor the academic performance of the students including attendance and to inform the class committee.
- To attend to the students' welfare activities like awards, medals, scholarships and industrial visits.

9. CLASS COMMITTEE

9.1 A Class Committee consists of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. The overall goal of the Class Committee is to improve the teaching-learning process. The functions of the Class Committee include:

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the programme and the details of rules therein.
- Informing the student representatives, the "academic schedule" including the dates of assessments and the syllabus coverage for each assessment period.
- Informing the student representatives, the details of regulations regarding the weightages used for each assessment. In the case of practical courses (laboratory / project work / seminar etc.) the breakup of marks for each experiment/ exercise/ module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students of the class after each test and finding the ways and means of improving the Students Performance
- Identifying the weak students, if any, in any specific subject and requesting the teachers concerned to provide some additional help or guidance or coaching to

such weak students as frequently as possible.

9.2 The class committee for a class under a particular programme is normally constituted by the Head of the Department. However, if the students of different programmes are mixed in a class, the class committee is to be constituted by the Head of the Institution.

9.3 The class committee shall be constituted on the first working day of any semester or earlier.

9.4 At least 2 student representatives (usually 1 boy and 1 girl) shall be included in the class committee.

9.5 The chairperson of the class committee shall invite the class advisor(s) and the Head of the Department to the meeting of the class committee.

9.6 The Head of the Institution may participate in any class committee of the institution.

9.7 The Chairperson of be Class Committee is required to prepare the minutes of every meeting, submit the same to the Head of the Institution within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the management, the same shall be brought to the notice of the management by the Head of the Institution.

9.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester in order to inform the students about the nature and weightages of assessments within the framework of the Regulations. Two or three subsequent meetings may be held at suitable intervals. During these meetings the student members, representing the entire class, shall meaningfully interact and express the opinions and suggestions of the class students to improve the effectiveness of the teaching-learning process.

9.9 COURSE COMMITTEE FOR COMMON COURSES

Each common course offered to more than one group of students shall have a “Course Committee” comprising all the teachers teaching the common course with one of them nominated as Course Coordinator. The nomination of the course Coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several departments. The ‘Course committee’ shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the course committee may also prepare a common question paper for the Assessment Test(s).

10. ATTENDANCE REQUIREMENTS FOR COMPLETION OF THE SEMESTER

10.1 A student who has fulfilled the following conditions shall be deemed to have satisfied the attendance requirements for completion of a end semester.

Ideally every student is expected to attend all classes and earn 100% attendance. However in order to allow provision for certain unavoidable reasons such as prolonged hospitalization / accident / specific illness the student is expected to earn a minimum of 75% attendance to become eligible to appear for the End-Semester Examinations.

Therefore, every student shall secure not less than 75% of overall attendance in that semester as per clause 5.3.

10.2 However, a candidate who secures overall attendance between 65% and 74% in that current semester due to medical reasons (prolonged hospitalization / accident / specific illness / participation in sports events) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate to the Head of the Institution.

10.3 Candidates who secure less than 65% overall attendance and who do not satisfy the clauses 10.1 &10.2 will not be permitted to appear for the End-Semester Examination of that current semester and are not permitted to go to next semester. They are required to repeat the same semester in the next academic year as per the norms prescribed by the Directorate of Technical Education, TN and Anna University.

10.4 However the candidates who secure less than 65% and above 55% of overall attendance may apply for condonation of shortage of attendance on genuine grounds. Application for condonation of shortage of attendance along with the prescribed fee should be forwarded so as to be received in the office of the Controller of Examinations along with the final attendance statement within 7 working days, before the commencement of the semester examination. Candidate can seek condonation of shortage of attendance only once in the entire duration of a course.

11. ASSESSMENT PROCEDURE FOR AWARDING MARKS

The maximum marks assigned to different courses shall be as given below:

Each of the Theory Courses, Lab Embedded Theory Courses, Theory with Lab Component Courses and Employability Enhancement Courses (Mini Project, Project Work Phase – I and Project Work Phase – II) shall carry a maximum of 100 marks of which 40 marks will be through Continuous Internal Assessment (CIA) and the End Semester Examination will carry 60 marks.

11.1 The marks for the continuous assessment shall be awarded as per the procedure given below:

(i) Theory Courses

For theory courses specified in curriculum out of 100 marks, the maximum marks for Continuous Internal Assessment (CIA) is fixed as 40 marks and the End Semester Examination (ESE) carries 60 marks.

The End Semester Examinations for theory and laboratory courses will be of 3 hours duration (Forenoon: 10.00 a.m. – 1.00 p.m., Afternoon: 2.00 p.m. – 5.00 p.m.) and shall normally be conducted between October and December during the odd semesters and between April and June during the even semesters.

The End Semester Examination is mandatory requirement for passing the course and every student should appear for the examination for theory, laboratory courses and project work.
Continuous Internal Assessment tests are conducted by the Internal Exam Cell of the college. Continuous Internal Assessment comprises three tests and their weightages are given below.

Continuous Internal Assessments (CIA)	Portion of the Syllabus	Duration of CIA	Max. Exam Mark	CIA Mark Allocation
Co-Curricular Component*	-	-	-	10
Continuous Internal Assessment 1	1½ units	1½ hours	50 marks	10
Continuous Internal Assessment 2	1½ units	1½ hours	50 marks	10
Continuous Internal Assessment 3	2 units	1½ hours	50 marks	10
Total				40

*Continuous Internal Assessment marks for Co-curricular component related to the subjects offered in that semester are awarded as below on submission of subject wise report to the faculty concerned:

- Online learning / Webinar
- Seminar Presentation
- Industrial component
- Assignment / Report

In case a student has not appeared for the assessment due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Department / Principal, a reassessment may be given at the end of the

semester after getting approval from the Head of the Department through the class advisor concerned.

(ii) Laboratory Courses

For Laboratory Course, out of 100 marks, the maximum marks for Continuous Internal Assessment (CIA) is fixed as 40 marks and the End Semester Examination carries 60 marks. Every laboratory exercise / experiment shall be evaluated based on the student performance during the laboratory class and the student's laboratory records are maintained. There shall be at least one assessment test. The criteria for arriving at the observation mark (20 marks) shall be decided in the respective course committee meeting. Mark of each laboratory class should be rounded to the nearest higher integer for assessment of internal marks. The End Semester Practical Examination for laboratory courses will be of 3 hours duration and shall normally be conducted between October and December during the odd semesters and between April and June during the even semesters.

The student who fails in the laboratory course shall reappear for the same in the subsequent end semester exams.

Category	CIA Mark
Observation Mark	20
Record Mark	10
Model Exam	10
Total	**40**

(iii) Lab Embedded Theory Courses

The assessment of the embedded theory shall be as that of theory (vide clause 11.1. (i)) and the assessment of the embedded lab shall be as that of the lab (vide clause 11.1. (ii)) and the cumulative mark will be calculated based on the theory and laboratory components giving 60 % weightage for theory and 40 % weightage for laboratory. The End Semester Examination for theory and laboratory components will be of three hours duration each.

(iv) Lab Component Theory Courses

The assessment of Lab Component Theory Course shall be consisted of 2 Continuous Internal Assessment (10 + 10 – 20% weightage) and one Practical (which consists of minimum 5 experiments) exam shall be conducted as per regular practical for 100 marks from which 20% weightage taken for Continuous Internal Assessment. The overall 40% weightage evaluation shall be given for Lab Component Theory Course.

(v) Employability Enhancement Courses

(a) The Seminar / Mini Project - Course - is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 3 seminars for seminar and 3 presentation for mini project before the evaluation committee and for each seminar and presentation marks can be equally apportioned. The three members committee appointed by Head of the Department will evaluate the seminar and presentation at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper / Concept (30%), presentation (40%) and response to the questions asked during presentation (30%).

(b) The Industrial / Practical Training shall carry 100 marks and shall be evaluated through internal assessment only. At the end of Industrial / Practical training / internship / Summer Project, the candidate shall submit a certificate from the organization where he / she has undergone training and a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a three member Departmental Committee constituted by the Head of the Institution. Certificates submitted by the candidate shall be attached to the mark list sent by the Head of the Department.

(c) For all the courses under Employability Enhancement Courses Category, except the Project Work, the evaluation shall be done with 100% internal marks.

11.2 Assessment for Value Added Course

The one / two credit course shall carry 100 marks and shall be evaluated through **Continuous Internal Assessments only**. Two Assessments shall be conducted during the semester by the Department concerned. The total marks obtained in the tests shall be reduced to 100 marks and rounded to the nearest integer. A committee consisting of the Head of the Department, staff handling the course and a senior Faculty member nominated by the Head of the Institution shall monitor the evaluation process. The list of students along with the marks and the grades earned may be forwarded to the Controller of Examinations for appropriate action atleast one month before the commencement of End Semester Examinations.

11.3 Assessment for Online Courses

Students may be permitted to credit one online course (which are provided with certificate) subject to a maximum of three credits. The approved list of online courses will be provided by the Centre for Academic courses from time to time. This online course of 3 credits can be considered instead of one elective course. The student needs to obtain certification or credit to become eligible for writing the End Semester Examination to be conducted by Anna University. The course shall be evaluated through the End Semester Examination only conducted by Controller of Examinations.

11.4 Every teacher is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' which consists of attendance marked in each lecture or practical or project work class, the test marks and the record of class work (topics covered), separately for each course. This should be submitted to the Head of the Department periodically (at least three times in a semester) for checking the syllabus coverage and the records of test marks and attendance. The Head of the department will put his signature and date after due verification.

12. REQUIREMENTS FOR APPEARING FOR SEMESTER EXAMINATION

12.1 A candidate shall normally be permitted to appear for the End Semester Examinations of the current semester if he/she has satisfied the semester completion requirements as per clause 10.1 & 10.2 and has registered for examination in all courses of the current semester.

12.2 Further, registration is mandatory for all the courses in the current semester as well as for arrear(s) course(s) for the End Semester Examinations failing which, the candidate will not be permitted to move to the higher semester.

12.3 A student who has passed all the courses prescribed in the curriculum for the award of the degree shall not be permitted to re-enroll to improve his/her marks in a course or the aggregate marks / CGPA.

13. END SEMESTER EXAMINATIONS

13.1 There shall be an End Semester Examination of 3 hours duration per course. The examinations shall ordinarily be conducted between October and December during the odd semesters and between April and June in the even semesters. For the practical examinations (including project work), both internal and external examiners shall be appointed by the College.

13.2 WEIGHTAGE

The following will be the weightage for different courses.

i) Theory Courses	
Continuous Internal Assessment	40 Marks
End Semester Examination	60 Marks
ii) Lab Embedded Theory Courses	
Continuous Internal Assessment	40 Marks
End Semester Examination	60 Marks

iii) Theory with Lab Component Courses	
Continuous Internal Assessment	40 Marks
End Semester Examination	60 Marks
iv) Project Work	
Continuous Internal Assessment	40 Marks
Evaluation of Project Report , Viva-Voce Examination By Internal Examiner, External Examiner and Supervisor	60 Marks
v) Industrial training / Internship / Practical training / Summer project / Seminar / Mini Project (All Employability Enhancement Courses except Project Work)	100 Marks

14. PASSING REQUIREMENTS

14.1 A candidate who secures not less than 50% of total marks prescribed for the course with a minimum of 50% of the marks prescribed for each of the course of the End-Semester University Examination in both theory and practical courses shall be declared to have passed in the course and acquired the relevant number of credits.

14.2 If a student fails to secure a pass in a particular course, it is mandatory that he/she shall reappear for the examinations in that course during the subsequent semester when examination is conducted in that course.

14.3 If the course, in which the student has failed, is a professional elective or an open elective, the student may be permitted to register for the same course in subsequent semester.

14.4 The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for three attempts. From the third attempt if a candidate fails to obtain pass marks (continuous assessment + End Semester Examinations) as per clause 14.1 then the candidate declared to have passed their examination if he/she secures a minimum of 50% marks prescribed for end semester examinations alone.

14.5 If a student fails to secure a pass in a laboratory course, the student shall register for the course again during the subsequent semester.

14.6 If a student fails to secure a pass in project work, the student shall register for the course again during the subsequent semester.

14.7 The passing requirement for the courses which are assessed only through purely internal assessment (EEC courses except project work), is 50% of the internal

assessment marks only.

14.8 If a student has failed in the final semester examination he/ she may be allowed to register for the course in the next semester itself.

15. AWARD OF LETTER GRADES

15.1 All assessments of a course will be evaluated on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each subject as detailed below:

Letter Grade		Grade Points	Marks Range
O	Outstanding	**10**	**91 - 100**
A+	Excellent	**9**	**81 - 90**
A	Very Good	**8**	**71 - 80**
B+	Good	**7**	**61 - 70**
B	Average	**6**	**50 - 60**
RA	Reappearance	**0**	**<50**
AB	Absent	**0**	
W	Withdrawal	**0**	
CC	Course Completed	**-**	**>=50**
CNC	Course Not Completed	**-**	**<50**

A student is deemed to have passed and acquired the corresponding credits in a particular course if he/she obtains any one of the following grades: “O”, “A+”, “A”, “B+”,“B”, "RA" denotes Reappearance required for the examinations in the course. “AB” denotes absent for the particular course. “W” denotes withdrawal from the exam for the particular course. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet. But if the grade RA is given to a Laboratory Course / Project work / Seminar and any other EEC course, the attendance requirements (vide clause 10) should be satisfied.

For Zero Credit Course, Course Completed “CC”, Course Not Completed ‘CNC” shall be printed in the Grade sheet Grade Column.

15.2 GRADE SHEET

After declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

- The college in which the candidate has studied.
- The list of courses enrolled during the semester and the grades scored.
- The Grade Point Average (GPA) for the semester and
- The Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA for a semester is the ratio of the sum of the products of the number of credits for courses acquired and the corresponding points to the sum of the number of credits for the courses acquired in the semester. CGPA will be calculated in a similar manner, considering all the courses registered from first semester. RA grades will be excluded for calculating GPA and CGPA.

$$\text{GPA} = \frac{\sum(\text{Credits Acquired} \times \text{Grade Points})}{\sum(\text{Credits Acquired})}$$

$$\text{CGPA} = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

where

$\mathbf{C_i}$ is the number of credits assigned to the course

$\mathbf{GP_i}$ is the Grade point corresponding to the grade obtained for each Course

n is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

16. ELIGIBILITY FOR THE AWARD OF THE DEGREE

16.1 A student shall be declared to be eligible for the award of the PG Degree (M.E.) provided the student as

i. Successfully gained the required number of total credits as specified in the curriculum corresponding to the student's programme within the stipulated time.

ii. Successfully completed the course requirements, appeared for the End-Semester examinations and passed all the subjects prescribed in all the 4 semesters within a maximum period of 4 years reckoned from the

commencement of the first semester to which the candidate was admitted.

iii. Successfully passed any additional courses prescribed by the College. No disciplinary action pending against the student.

iv. The award of Degree must have been approved by the Syndicate of the University.

17. CLASSIFICATION OF THE DEGREE AWARDED

17.1 FIRST CLASS WITH DISTINCTION

A Student who satisfies the following conditions shall be declared to have passed the examination in **First Class with Distinction**:

- Should have passed the examination in all the courses of all the four semesters in the student's First Appearance within **three** years, which includes authorized break of study of one year (if availed). Withdrawal from examination will not be considered as an appearance.
- Should have secured a CGPA of not less than **8.50.**
- Should NOT have been prevented from writing end Semester examination due to lack of attendance in any of the courses.

17.2 FIRST CLASS

A student who satisfies the following conditions shall be declared to have passed the examination in **First class**:

- Should have passed the examination in all the courses of all four semesters **within three years**, which includes one year of authorized break of study (if availed) or prevention from writing the End Semester Examination due to lack of attendance (if applicable).
- Should have secured a CGPA of not less than **7.00.**

17.3 SECOND CLASS

All other students (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree shall be declared to have passed the examination in **Second Class**. A student who is absent in End Semester Examination in a course / project work after having registered for the same shall be considered to have appeared in that examination (except approved withdrawal from end semester examinations as per clause 18) for the purpose of classification.

18. REVALUATION

A candidate can apply for revaluation of his / her semester examination answer paper in a theory course, within a week from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of Institution. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the Institution. **Revaluation is not permitted for practical courses and for project work.**

19. PROVISION FOR WITHDRAWAL FROM EXAMINATION

A candidate, may for valid reasons with prior application, be granted permission to

19.1 Withdraw from appearing for the examination of any one course or consecutive examinations of more than one course in a semester examination.

19.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

19.3 Withdrawal of application is valid only if it is made within 10 days prior to the Commencement of the examination in that course or courses and recommended by the Head of the institution and approved by the Controller of Examinations.

19.4 Even though the requirement of mandatory is 10 days notice, applications for Withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

19.5 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

19.6 Withdrawal from the End Semester Examination is NOT applicable to arrear subjects of previous semesters.

19.7 The candidate shall reappear for the withdrawn courses during the examination conducted in the immediate semester.

19.8 Withdrawal shall not be permitted in the final semester examinations.

19.9 Withdrawal shall not be permitted for all papers in a semester. He/she has to appear at least for one paper in a semester. Otherwise he/she shall be considered as break of study.

20. PROVISION FOR AUTHORIZED BREAK OF STUDY

20.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the DOTE, University, in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore

and the probable date of rejoining the programme. However, if the candidate has not completed the first semester of the programme, Break of Study will be considered only on valid medical reasons.

20.2 The candidates permitted to rejoin the programme after break of study/prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. Students rejoining in new Regulations should appear in additional courses if any, as prescribed by admission committee from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

20.3 One year authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 20.1 and 20.2).

20.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

20.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' and Clause 20.3 is not applicable for this case.

20.6 All the norms may liable to change upon the terms of affiliated University.

21. DISCIPLINE

21.1 Every student is required to observe discipline both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the college. The Head of the Institution shall constitute a disciplinary committee consisting of Dean (Student Affairs), Head of the Departments to which the student concerned belongs, and the Head of another Department to enquire into acts of indiscipline and to recommend the principal for taking final decision.

21.2 If a student indulges in malpractice in any of the examinations, the student shall be liable for punitive action as prescribed in the regulations from time to time.

22. REVISION OF REGULATIONS, CURRICULUM AND SYLLABI

The college may from time to time revise, amend or change the Regulations, Curriculum, Syllabi and Scheme of examinations through the Board of Studies and Academic Council with the approval of the Governing Body of the college.

****

SENGUNTHAR ENGINEERING COLLEGE

(AUTONOMOUS)

TIRUCHENGODE – 637205, Namakkal District

PG (M.B.A.) REGULATIONS - 2021

CHOICE BASED CREDIT SYSTEM

(For the students admitted to M.B.A. Programme from the Academic Year 2021-2022 onwards)

Regulations-2021 has been prepared in accordance with the guidelines given by the University Grants Commission, All India Council for Technical Education and affiliated University in the aspect of the Choice Based Credit System (CBCS).
The "Regulations 2019" is applicable to the candidates admitted to the Master of Business Administration Degree Programme of the Institution in the academic year 2019-2020 and subsequently.

1. DEFINITIONS

In these Regulations, unless the context otherwise requires:

i. "**University**" means ANNA UNIVERSITY, CHENNAI.

ii. "**College"** means SENGUNTHAR ENGINEERING COLLEGE.

iii. "**Programme**" means Post graduate Degree Programme M.B.A. (Master of Business Administration)

iv. "**Branch**" means Business Administration.

v. "**Course**" means a theory or practical subject that is studied in a Semester, like Managerial Economics, Marketing Management, Human Resource Management, Business Application Software lab, etc.

vi. "**Credit**" means a numerical value allocated to each course to describe the candidate's workload required per week.

vii. "**Grade**" means the letter grade assigned to each course based on the marks range specified.

viii. "**Grade Point**" means a numerical value (0 to 10) allocated based on the grade assigned to each course.

ix. "**Head of the Institution**" means Principal of the College and also the Chairman, Academic Council of the College.

x. **"Controller of Examinations"** means the Authorized person who is responsible for all examinations of the College.

xi. **"Head of the Department"** means Concerned Head of the Department of the College.

2. PREAMBLE

Sengunthar Engineering College with a spotlighted vision and mission of imparting quality technical education to go with latest technologies is accelerating several initiatives towards successful academic excellence and quality improvement.

In view of this, the Choice Based Credit System (CBCS) is being introduced from the academic year 2019-2020, to build up interdisciplinary and multidisciplinary approach with advances in learner centric programmes and life-long learning prospective with enriched and flexible curriculum.

The proposed academic structure under the Choice Based Credit System shall make all innovations possible, preparing the students to face the professional & managerial challenges.

3. PROGRAMME OFFERED

Programme Code	Degree	Branch of Study
BA	M.B.A.	Master of Business Administration

3.1 Mode of Study

Candidates admitted under M.B.A. Programme should be available in the College / Institution during the entire duration of working hours (from morning to evening on Full-Time basis) for the curricular, co-curricular and extra-curricular activities assigned to them.

The Full-Time candidates should not attend any other Full-Time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or Company during the period of the Full-Time programme. Violation of the above rules will result in cancellation of admission to the PG programme.

4. DURATION OF THE PROGRAMME

4.1 The programme will lead to the Degree of Master of Business Administration of the Anna University, Chennai and spread over a period of **two years**. The two academic years will be divided into **four Semesters** with two Semesters per year.

4.2 A student is ordinarily expected to complete the M.B.A. Programme in **four** Semesters (two academic years) but in any case not more than eight consecutive Semesters (4 years). These periods being reckoned from the commencement of the Semester to which the candidate was first admitted.

4.3 The Curriculum and Syllabi of all Programme shall be approved by the Academic Council of the College. The number of Credits to be earned for the successful completion of the programme shall be as specified in the Curriculum of the Programme.

4.4 Each Semester shall normally consist of 80 working days. The Principal shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

4.5 The minimum prescribed credits required for the award of the degree shall be within the limits specified in the curriculum.

5. ADMISSION CRITERIA

Candidates for admission to the M.B.A. degree programme will be required to satisfy the conditions of admission thereto prescribed by the Anna University, Chennai and Government of Tamil Nadu, as given below:

S. No.	Course	Eligibility Norms
1.	M.B.A.	1. A pass in any degree from a recognized University with 10+2+3/4 year's pattern. 2. A pass in any degree from a recognized University with 10+3 (Diploma) + 3 years pattern. 3. Candidates who have already passed the above qualifying Degree course and candidates who have appeared for the final semester/ year examination of the said qualifying degree course during April/May may apply for admission to M.B.A degree programme along with TANCET **/** MAT **/** CONSORTIUM score.

6. STRUCTURE OF THE PROGRAMME

6.1. The Programme will have a curriculum and syllabi consisting of Theory Courses, Elective courses, Practical, Employability Enhancement Courses (Spoken and Written Communication, Creativity and Innovation, Summer Training and Project Work) as prescribed by the respective Board of Studies from time to time.

6.1.1. The electives from the curriculum are to be chosen with the approval of the Head of the Department.

6.1.2. The students have to opt for two specializations (electives) each with three courses in third semester along with two core courses.

6.2 Medium of Instruction

The medium of instruction, examination, Practical, Summer Training and Main Project report shall be in English.

6.3 Credit Assignment

Each course is assigned certain number of credits based on the following:

CONTACT PERIOD PER WEEK	CREDITS
3 Lecture / Tutorial Periods	3
4 Lecture / Tutorial Periods	4
2 Practical Periods (Laboratory / Summer Training / Main Project Work / etc.)	1
4 Practical Periods (Laboratory / Summer Training / Main Project Work / etc .)	2
24 Practical Periods (Laboratory / Summer Training / Main Project Work / etc .)	12

The Minimum Credits to be earned by the students should be 86.

6.4 Summer Training

6.4.1. The Summer Training of M.B.A. Programme shall be carried out under the Supervision of a faculty member.

6.4.2. Normal duration for the Summer Training is 28 calendar days (4 weeks).

6.4.3. The deadline for submission of the rough draft of the Summer Training report is the 30th day after the commencement of the Third Semester.

6.4.4. If a candidate fails to submit the Summer Training report on or before the specified deadline, the candidate is deemed to have failed in the Summer Training and shall register for the same in the succeeding Semester.

6.4.5. The maximum marks for Summer Training is 100 marks, consisting of 40 marks for Internal and 60 marks for Viva –Voce.

6.4.6. The Internal marks will be awarded by the supervisor of the Candidate.

6.4.7. The Viva-Voce of the Summer Training shall be conducted along with Third Semester examinations by Internal Examiner appointed by Controller of Examinations.

6.4.8. The External marks shall be awarded for 100 marks during Viva-Voce examination, which will be converted to 60 marks.

6.4.9. The Total marks for Summer Training is 100 (Internal Marks - 40 and External Marks - 60).

6.4.10. A hard copy of the approved Summer Training report shall be kept in the library of the college and a soft copy at the Department.

6.5 Project Work

6.5.1. The Project Work of M.B.A Programme shall be carried out under the supervision of a faculty member.

6.5.2. The Project work shall be pursued for a minimum of 16 weeks during the final semester.

6.5.3. The deadline for submission of the project report is the last instruction day of the fourth Semester.

6.5.4. If a candidate fails to submit the project report on or before the specified deadline, the candidate is deemed to have failed in the Project Work and shall register for the same in the next year Project Work.

6.5.5. The Viva-Voce of the Project Work shall be conducted as per the Academic Calendar schedule in the fourth Semester.

6.5.6. A hard copy of the approved Project Work report shall be kept in the library of the college. A soft copy of the main project report shall keep in the Department.

6.5.7. The Internal marks will be awarded by the members of the Project review committee with the consent of the respective supervisors.

6.5.8. The External marks shall be awarded for 100 marks during Viva-Voce examination, which will be converted to 60 marks.

6.5.9. The Total marks for Project Work is 100 (Internal Marks – 40 and External Marks - 60).

7. CLASS ADVISOR

To help the students in planning their courses of study and for general advice on the academic programme, the Head of the Department will appoint a faculty member of the Department who shall function as class advisor for the particular class.

Such class advisor shall advise the students and monitor the courses undergone by the students, check the attendance and progress of the students attached to him/her and counsel them periodically.

If necessary, the class advisor may also discuss with or inform the parents about the progress of the students through the Head of the Department concerned**.**

8. CLASS COMMITTEE

8.1 Every class shall have a class committee consisting of teachers of the concerned class, student representatives and a chairperson who is not teaching the class. It is like the 'Quality Circle' (more commonly used in industries) with the overall goal of improving the teaching-learning process. The functions of the class committee include:

- Solving problems experienced by students in the class room and in the laboratories.
- Clarifying the regulations of the degree programme and the details of rules therein.
- Informing the student representatives the academic schedule including the dates of assessments and the syllabus coverage for each assessment.
- Informing the student representatives the details of Regulations regarding weightage used for each assessment. In the case of practical courses (laboratory / project work / seminar etc.) the breakup of marks for each experiment / exercise / module of work, should be clearly discussed in the class committee meeting and informed to the students.
- Analyzing the performance of the students after each test and finding the ways and means of solving problems, if any.
- Identifying the weak students, if any, and requesting the teachers concerned to provide some additional help of guidance or coaching to such weak students.

8.2 The class committee for a class under a particular branch is normally constituted by the Head of the department.

8.3 The class committee shall be constituted on the first working day of any Semester or earlier.

8.4 At least four student representatives (usually 2 boys and 2 girls) shall be included in the class committee.

8.5 The chairperson of the class committee may invite the Faculty Advisor(s) and the Head of the Department to the meeting of the class committee.

8.6 The Principal may participate in any class committee of the institution.

8.7 The chairperson is required to prepare the minutes of every meeting, submit the same to Principal within two days of the meeting and arrange to circulate among the concerned students and teachers. If there are some points in the minutes requiring action by the

management, the same shall be brought to the notice of the management by the head of the institution.

8.8 The first meeting of the class committee shall be held within one week from the date of commencement of the semester, in order to inform the students about the nature and weightage of assessments within the framework of the Regulations. Two or three subsequent meetings may be held in a semester at suitable intervals. During these meeting the student members express the opinions and suggestions of the other students of the class to improve the effectiveness of the teaching-learning process.

9. PROCEDURE FOR COMPLETING THE COURSE

9.1 For the purpose of these regulations, the academic year will be normally spanning the period from June to May. Each academic year will be divided into two Semesters, the first Semester normally spanning the period from July to December, the second Semester spanning the period from January to May.

9.2 The course work of the odd Semester will ordinarily be conducted only in odd Semester and that of the even Semester only in the even Semester.

9.3 A candidate will be permitted to proceed to the courses of study of any Semester only if he/she has satisfied the requirements of attendance, progress, character and conduct in respect of the preceding Semester and had registered for the higher Semester examination for which he / she was eligible to register.

9.4 A candidate who is required to repeat the study of any Semester for want of attendance, progress, character and conduct or who desires to rejoin the course after a period of discontinuance or who upon his/her own request is permitted by the authorities to repeat the study of any Semester, may join the Semester which he/she is eligible or permitted to rejoin, only at the time of its normal commencement for a regular batch of candidates and after obtaining the approval from Anna University, Chennai and the Director of Technical Education. No candidate will however be enrolled in more than one Semester at any time. In the case of repeaters, the earlier assessment in the repeated courses will be disregarded.

10. REQUIREMENTS FOR APPEARING FOR THE END SEMESTER EXAMINATION OF A COURSE

A student who has fulfilled the following conditions (vide clause 10.1 and 10.2) shall be deemed to have satisfied the attendance requirements for appearing for end semester examination of a particular course.

10.1 A candidate who has fulfilled the following conditions shall be deemed to have satisfied the attendance requirements for completion of a semester. Ideally every student is expected to

attend all classes and earn 100% attendance. However in order to allow provision for certain unavoidable reasons such as hospitalization / accident / specific illness the student is expected to earn a minimum of 75% attendance to become eligible to appear for the End-Semester Examinations.

Therefore, every student shall secure not less than 75% of overall attendance in that semester taking into account the total number of periods in all courses attended by the candidate as against the total number of periods in all courses offered during that semester.

10.2 However, a candidate who secures overall attendance between 65% and less than 75% in that current semester due to medical reasons (hospitalization / accident / specific illness / participation in sports events - College / University / State / National / International level Sports events with prior permission from the Head of the Department and Principal) may be permitted to appear for the current semester examinations subject to the condition that the candidate shall submit the medical certificate / sports participation certificate to the Head of the Institution.

10.3 The candidates who secure less than 65% and above 60% of overall attendance may apply for condonation of shortage of attendance on genuine grounds. Application for condonation of shortage of attendance along with the prescribed fee should be forwarded so as to be received in the office of the Controller of Examinations along with the final attendance statement within 7 working days, before the commencement of the semester examination. Candidate can seek condonation of shortage of attendance only once in the entire duration of a course.

10.4 However the Candidates who secure less than 60% overall attendance and who do not satisfy the clauses 10.1 & 10.2 will not be permitted to appear for the End Semester Examination of that current semester and are not permitted to go to next semester. They are required to repeat the same semester in the next academic year as per the norms prescribed by the Directorate of Technical Education, Tamilnadu and Anna University, Chennai.

11. SCHEME OF ASSESSMENT

ASSESSMENT PROCEDURE FOR AWARDING MARKS

M.B.A. Programme consists of Theory & Practical Courses. Employability Enhancement Courses includes Summer Training & Project Work in End Semester Examination is mandatory for all courses that are specified in the curriculum.

Performance in each course of study shall be evaluated based on (i) Continuous Internal Assessments throughout the semester and (ii) End Semester Examination at the end of the semester. For theory courses out of 100 marks, the maximum mark for Continuous Internal Assessment is fixed as 40 marks and the End Semester Examination carries 60 marks. For laboratory courses out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 40 marks and the End Semester Examination carries 60 marks for certain courses. For project work Continuous Internal Assessment carries 40 marks and End Semester Examination carries 60 marks (Project work, Project report evaluation and Viva voce). Each course shall be evaluated for a maximum of 100 marks as shown below:

S.No.	Category of Course	Continuous Internal Assessment	End Semester Examinations
1.	Theory Courses	40 Marks	60 Marks
2.	Laboratory / Practical Courses**	40 Marks	60 Marks
3	Employability Enhancement Course	100 Marks	-

** As specified in the Curriculum

Every faculty is required to maintain an 'ATTENDANCE AND ASSESSMENT RECORD' for every semester which consists of attendance marked in each Theory / Laboratory / EEC class the assessment marks and the record of class work (topics covered), separately for each course handled by the faculty. This should be submitted to the Head of the Department periodically (at least three times in a semester) for checking the syllabus coverage and the records of assessment marks and attendance.

The Head of the Department will fix his/her signature with date after due verification. At the end of the semester, the record should be verified by the Head of the Department who shall keep this document in safe custody (for five years).The records of attendance and assessment of both current and previous semesters should be available for inspection.

The internal assessment marks obtained by the candidate in the first appearance shall be retained and considered valid for all subsequent attempts till the candidate secure a pass.

ASSESSMENT FOR THEORY COURSES

For theory courses specified in curriculum out of 100 marks, the maximum marks for continuous assessment is fixed as 40 marks and the End Semester Examination carries 60 marks.

The End Semester examinations for theory and laboratory courses will be of 3 hours duration (Forenoon: 10.00 a.m. – 1.00 p.m., Afternoon: 2.00 p.m. – 5.00 p.m.) and shall normally be

conducted between October and December during the odd semesters and between April and June during the even semesters.

End semester Examination is mandatory requirement for passing the theory course, certain practical course and for Project Work.

Internal Assessment tests are conducted by the internal exam cell of the college. Continuous Internal Assessment comprises three internal assessment tests and their weightages are given below.

Procedure of Continuous Internal Assessment for each theory Course

S. No.	Item	Marks
1	Continuous Internal Assessment 1	10
2	Continuous Internal Assessment 2	10
3	Continuous Internal Assessment 3	10
4	Seminar	10
	Total	**40**

In case a student has not appeared for the assessment due to medical reasons (hospitalization / accident / specific illness) or due to participation in the College / University / State / National / International level Sports events with prior permission from the Head of the Department / Principal, a reassessment may be given at the end of the semester after getting approval from the Head of the Department through the faculty advisor concerned.

Procedure of Continuous Internal Assessment for Laboratory / Practical Course

S. No.	Item	Marks
1	Observation	20 Marks
2	Record	10 Marks
3	Model Exam / Viva Voce	10 Marks
	Total	**40 Marks**

Procedure of Evaluation of Project Work

Continuous Internal Assessment (40 Marks)				End Semester Examination (100 Marks)			
Review I	**Review II**	**Review III**	**Model Viva-Voce**	**Report Submission**	**Viva-Voce**		
5	10	10	15	**External Examiner**	**Internal Examiner**	**External Examiner**	**Supervisor Examiner**
				20	35	30	15

End Semester Examination:

Examination Duration : 3 Hours

Max. Marks : 100 (Will be converted to 60 marks)

ASSESSMENT FOR EMPLOYABILITY ENHANCEMENT COURSES

(a) Evaluation of Seminar

The Seminar is to be considered as purely INTERNAL (with 100% internal marks only). Every student is expected to present a minimum of 2 seminars per semester before the evaluation committee and for each seminar marks can be equally apportioned. A three member committee appointed by Head of the Institution consisting of course coordinator and two experts from the Department will evaluate the seminar and at the end of the semester the marks can be consolidated and taken as the final mark. The evaluation shall be based on the seminar paper (40%), presentation (40%) and response to the questions asked during presentation (20%).

(b) Evaluation of Summer Internship

Summer internship will comprise of 4 weeks. The students will be working under a department appointed guide The candidate shall submit an attendance certificate from the organization where he/she has undergone internship and a brief report. The evaluation for 100 marks will be carried out internally based on this report and a Viva Voce Examination will be conducted by a Departmental Committee constituted by the Head of the Institution. The evaluation will be done as follows: 20 marks for evaluation by the guide, 40 marks for the report and 40 marks for the viva voce examination. Certificates submitted by the students along with the report shall be sent by the Head of the Institution to the Controller of Examination.

(c) **Evaluation of Creativity and Innovation Laboratory**

The creativity and innovation laboratory course is an activity-based course with both theoretical and practical content and is to be considered as purely INTERNAL (with 100% internal marks only). Each student is expected to present seminars and to come out with innovative products or services. This will be evaluated by the faculty member(s) handling the

course and the consolidated marks can be taken as the final mark. No end semester examination is required for this course

12. SCHEME OF ASSESSMENT PASSING REQUIREMENTS AND PROVISIONS

12.1. A candidate who secures not less than 50% of total marks prescribed for the course with a minimum of 50% prescribed for the End Semester Examination and 50 % of Continuous internal Assessment shall be declared to have passed the course and acquired the relevant number of credits.

12.2. A candidate who lacks in attendance or who fails to submit the report on the Summer Training / Project Work (or whose report is not accepted for reasons of incompleteness or other serious deficiencies) within the prescribed date or whose project work and viva voce has been assessed as Grade AB will have to reregister at the beginning of a subsequent Semester following the Semester, repeat and submit the project report at the end of that Semester and appear for End Semester examination.

12.3 If a candidate fails in the End Semester Examinations, he/she shall resubmit the Project Report within 60 days from the date of declaration of the results. The resubmission of the Project Report and subsequent viva-voce examination will be considered as reappearance with payment of exam fee. For this purpose the same internal and external examiners shall evaluate the resubmitted report.

12.4 The passing requirement for the courses which are assessed only through purely internal assessment (EEC courses except project work), is 50% of the internal assessment marks only.

13. CREDIT SYSTEM AND ASSESSMENT

13.1 For awarding the grades, affiliating university guidelines is followed; It will be changed from time to time based on the guidelines of above affiliating authorities.

13.2 The letter grade and the grade point are awarded based on percentage of marks secured by a candidate in individual course as detailed below:

Letter Grade		Grade Points	Marks Range
O	Outstanding	**10**	**91 - 100**
A+	Excellent	**9**	**81 - 90**
A	Very Good	**8**	**71 - 80**
B+	Good	**7**	**61 - 70**
B	Average	**6**	**50 - 60**
RA	Reappearance	**0**	**<50**
AB	Absent	**0**	
W	Withdrawal	**0**	
CC	Course Completed	**-**	**>50**
CNC	Course Not Completed	**-**	**<50**

"RA" denotes failure in the course and he/she has to reappear for the End of Semester Examination. “AB” denotes absent for the End of Semester Examination and he/she has to reappear for the End Semester examination."W" denotes withdrawal from the End of Semester Examination. The grades RA and W will figure both in Marks Sheet as well as in Result Sheet. But if the grade RA is given to a Laboratory Course / Project work / Seminar and any other EEC course, the attendance requirements (vide clause 10) should be satisfied.

For Zero Credit Course, Course Completed “CC” , Course Not Completed ‘CNC” shall be printed in the Grade sheet Grade Column.

GPA AND CGPA CALCULATON

After the completion of the programme, the Cumulative Grade Point Average (CGPA) from the first Semester to final Semester is calculated using the formula:

$$\text{GPA} = \frac{\sum(\text{Credits Acquired} \times \text{Grade Points})}{\sum(\text{Credits Acquired})}$$

$$\text{CGPA} = \frac{\sum_{i=1}^{n} C_i GP_i}{\sum_{i=1}^{n} C_i}$$

where

$\mathbf{C}_i$ is the number of credits assigned to the course

$\mathbf{GP}_i$ is the Grade point corresponding to the grade obtained for each Course

n is number of all Courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

13.3 A candidate will be permitted to appear for the End Semester examination of a Semester only if the candidate has completed the study of that Semester (vide Clause 10). A candidate will not be allowed to register for any End Semester examination unless the candidate simultaneously registers for the examinations of the highest Semester eligible and all the courses in which he/she has arrears. In the case of examination in project work, no candidate will be permitted to appear for the project work examination unless he /she had submitted the project report on or before the prescribed date.

13.4 A candidate who is absent in End Semester examination in a course / project work after having registered for the same shall be considered to have appeared and failed in that course /project work and awarded grade RA.

13.5 If a candidate fails to submit the report on project work on or before the date specified by the college / department, the candidate is deemed to have failed in the project work and awarded grade RA.

13.6 The assessment will comprise of Continuous Internal Assessment and End Semester examination carrying marks as specified by Clause 10.

13.7 End Semester examinations will normally be conducted during December/January and during May/June of each year.

13.8 Continuous Internal Assessment marks will be awarded on the basis of continuous assessment made during the Semester as per guidelines framed by the College.

14. ISSUE OF MARK SHEET & DEGREE CERTIFICATE

After the publication of the results by the college in each Semester, the college will issue the grade statements. After successful completion of the degree, the college will recommend the candidate to the University, which in turn shall award the degree.

15. CLASSFICATON OF THE DEGREE AWARDED

15.1 A candidate shall be declared to have qualified for the award of the M.B.A. Degree provided the candidate has successfully completed the course requirements and has passed all the prescribed courses of study in all the four Semesters within a maximum period of 4 years reckoned from the commencement of the Semester to which the candidate was first admitted.

15.2 A candidate who qualifies for the award of the Degree (vide Clause 15.1) having passed all the courses of study of all the four Semesters at the first opportunity within four consecutive Semesters after the commencement of his /her study and securing a **CGPA of 8.50 and above** in the **four Semesters** shall be declared to have passed in **First Class with Distinction**. For this purpose the withdrawal from examination (vide Clause 17) will not be construed as an opportunity for appearance in the examination.

15.3 A candidate who qualifies for the award of the Degree (vide clause 15.1) having passed all the courses of study of Semesters 1 to 4 within a maximum period of four consecutive Semesters after commencement of his / her study and securing a **CGPA of 7 and above** in all the **four Semesters** shall be declared to have passed in **First Class**.

15.4 All other candidates who qualify for the award of the degree shall be declared to have passed in **Second Class.**

16. REVALUATION

A candidate can apply for photocopy of his/her semester examination answer paper in a theory course, within a week from the declaration of results, on payment of a prescribed fee through proper application to the Controller of Examinations through the Head of institution. The answer script is to be valued and justified by a faculty member, who is not handled the subject and recommend for revaluation with breakup of marks for each question. Based on the recommendation, the candidate can register for the revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for the revaluation and the results will be intimated to the candidate concerned through the Head of the institution. Revaluation is not permitted for practical courses and for project work. A candidate can apply for revaluation of answer scripts for not exceeding 5 subjects at a time.

17. WITHDRAWAL FROM THE EXAMINATION

A Candidate may, for valid reasons with prior application, be granted permission to :

17.1 Withdraw from appearing for the examination of any one course or consecutive Examinations of more than one course in a semester examination.

17.2 Such withdrawal shall be permitted only once during the entire period of study of the degree programme.

17.3 Withdrawal of application is valid only if it is made within 10 days prior to the Commencement of the examination in that course or courses and recommended by the Head of the institution and approved by the Controller of Examinations.

17.4 Even though the requirement of mandatory is 10 days notice, applications for Withdrawal for special cases under extraordinary conditions will be considered on the merit of the case.

17.5 Withdrawal shall not be construed as an appearance for the eligibility of a candidate for First Class with Distinction.

17.6 Withdrawal from the End Semester Examination is NOT applicable to arrear subjects of previous semesters.

17.7 The candidate shall reappear for the withdrawn courses during the examination conducted in the immediate semester.

17.8 Withdrawal shall not be permitted in the final semester examinations.

17.9 Withdrawal shall not be permitted for all papers in a semester. He/she has to appear at least for one paper in a semester. Otherwise he/she shall be considered as break of study.

18. PROVISION FOR AUTHORISED BREAK OF STUDY

18.1 Break of Study shall be granted only once for valid reasons for a maximum of one year during the entire period of study of the degree programme. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for break of study. If a candidate intends to temporarily discontinue the programme in the middle of the semester for valid reasons, and to rejoin the programme in a subsequent year, permission may be granted based on the merits of the case provided he / she applies to the DOTE, Anna University, in advance, but not later than the last date for registering for the end semester examination of the semester in question, through the Head of the Institution stating the reasons therefore and the probable date of rejoining the programme. However, if the candidate has not completed the first semester of the programme, Break of Study will be considered only on valid medical reasons.

18.2 The candidates permitted to rejoin the programme after break of study/prevention due to lack of attendance, shall be governed by the Curriculum and Regulations in force at the time of rejoining. Students rejoining in new Regulations should appear in additional courses if any, as prescribed by admission committee from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.

18.3 One year authorized break of study will not be counted towards the duration specified for passing all the courses for the purpose of classification (vide Clause 18.1 and 18.2).

18.4 The total period for completion of the Programme reckoned from, the commencement of the first semester to which the candidate was admitted shall not exceed the maximum period specified in clause 4.2 irrespective of the period of break of study in order that he/she may be eligible for the award of the degree.

18.5 If any student is detained for want of requisite attendance, progress and good conduct, the period spent in that semester shall not be considered as permitted 'Break of Study' and Clause 18.3 is not applicable for this case.

18.6 All the norms may liable to change upon the terms of affiliated university.

19. DISCIPLINE

Every student is required to observe discipline both inside and outside the college and not to indulge in any activity which will tend to bring down the prestige of the college. The Head of the Institution shall constitute a disciplinary committee consisting of Dean (Student Affairs), Head of the Departments to which the student concerned belongs, and the Head of another Department to enquire into acts of indiscipline and to recommend the principal for taking final decision.

If a student indulges in malpractice in any of the examinations, the student shall be liable for punitive action as prescribed in the regulations from time to time.

20. INDUSTRIAL VISIT

Every student is required to undergo one industrial visit, starting from the first semester of the programme.

21. REVISION OF REGULATION AND CURRICULUM

The college may from time to time revise, amend or change the Regulations, Curriculum Syllabus and Scheme of examinations through the Board of Studies and Academic Council with the approval of the Governing Council of the college.

*****

CURRICULUM AND SYLLABI

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

(For the Students admitted in the Academic Year 2021-2022 onwards)

FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCM101	Applied Mathematics for Computer Science	FC	3	1	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100
21PCT101	Machine Learning Techniques	PC	3	0	0	3	40	60	100
21PCT102	Web Engineering	PC	3	0	2	4	40	60	100
21PCE101	Advanced Data Structures and Algorithms	PC	3	0	2	4	40	60	100
	Professional Elective –I	PE	3	0	0	3	40	60	100
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	-	100
TOTAL CREDITS IN SEMESTER- I			21						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCT201	Advanced Soft Computing	PC	3	0	0	3	40	60	100
21PCT202	Industrial IoT	PC	3	0	0	3	40	60	100
21PCE201	Data Science and Analytics	PC	3	0	2	4	40	60	100
	Professional Elective–II	PE	3	0	0	3	40	60	100
	Professional Elective–III	PE	3	0	0	3	40	60	100
	Open Elective	OE	3	0	0	3	40	60	100
21PEE201	Mini Project	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER- II			20						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
	Professional Elective –IV	PE	3	1	0	4	40	60	100
	Professional Elective –V	PE	3	1	0	4	40	60	100
	Professional Elective –VI	PE	3	0	0	3	40	60	100
21PEE301	Project Work Phase – I	EEC	0	0	12	6	40	60	100
TOTAL CREDITS IN SEMESTER- III			17						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE401	Project Work Phase – II	EEC	0	0	24	12	40	60	100
TOTAL CREDITS IN SEMESTER -IV			12						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOUNDATION COURSES (FC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCM101	Applied Mathematics For Computer Science	FC	3	1	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100

PROFESSIONAL CORE (PC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCT101	Machine Learning Techniques	PC	3	0	0	3	40	60	100
21PCT102	Web Engineering	PC	3	0	2	4	40	60	100
21PCE101	Advanced Data Structures and Algorithms	PC	3	0	2	4	40	60	100
21PCT201	Advanced Soft Computing	PC	3	0	0	3	40	60	100
21PCT202	Industrial IoT	PC	3	0	0	3	40	60	100
21PCE201	Data Science and Analytics	PC	3	0	2	4	40	60	100

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE- I – SEMESTER I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP101	Advanced Databases	PE	3	0	0	3	40	60	100
21PCP102	Agile Software Development and Usability Engineering	PE	3	0	0	3	40	60	100
21PCP103	Image Processing and Analysis	PE	3	0	0	3	40	60	100
21PCP104	Mobile Application Development	PE	3	0	0	3	40	60	100
21PCP105	Cloud Services and Virtualization	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- II – SEMESTER II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP201	Real Time Systems	PE	3	0	0	3	40	60	100
21PCP202	Data Visualization Techniques	PE	3	0	0	3	40	60	100
21PCP203	Integrated Software Project Management	PE	3	0	0	3	40	60	100
21PCP204	Modern Computer Architecture	PE	3	0	0	3	40	60	100
21PCP205	Software Architectures and Design	PE	3	0	0	3	40	60	100

ROFESSIONAL ELECTIVE- III – SEMESTER II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP206	Human Computer Interaction	PE	3	0	0	3	40	60	100
21PCP207	Block Chain Technology	PE	3	0	0	3	40	60	100
21PCP208	Computer Vision	PE	3	0	0	3	40	60	100
21PCP209	Cyber Security and Computer Forensics	PE	3	0	0	3	40	60	100
21PCP210	Software Quality Assurance and Testing	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- IV – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP301	Security for IoT	PE	3	1	0	4	40	60	100
21PCP302	Parallel Programming Paradigms	PE	3	1	0	4	40	60	100
21PCP303	Design Thinking	PE	3	1	0	4	40	60	100
21PCP304	Performance Analysis of Computer Systems	PE	3	1	0	4	40	60	100
21PCP305	Compiler Optimization Techniques	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE-V – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP306	Cognitive Computing	PC	3	1	0	4	40	60	100
21PCP307	Security Practices	PC	3	1	0	4	40	60	100
21PCP308	Network Design and Technologies	PC	3	1	0	4	40	60	100
21PCP309	Embedded Software Development	PE	3	1	0	4	40	60	100
21PCP310	Natural Language Processing	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE-VI – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PCP311	Bio-inspired Computing	PE	3	0	0	3	40	60	100
21PCP312	Speech Processing and Synthesis	PE	3	0	0	3	40	60	100
21PCP313	Information Security Risk Management	PE	3	0	0	3	40	60	100
21PCP314	Deep Learning	PE	3	0	0	3	40	60	100
21PCP315	Cyber Security Standards and Audits	PE	3	0	0	3	40	60	100

OPEN ELECTIVE- I – SEMESTER II

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PGO201	Disaster Management	OE	3	0	0	3	40	60	100
21PGO202	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
21PGO203	Constitution of India	OE	3	0	0	3	40	60	100
21PGO204	Business Analytics	OE	3	0	0	3	40	60	100
21PGO205	Digital Marketing	OE	3	0	0	3	40	60	100

CURRICULUM AND SYLLABI

DEPARTMENT OF CIVIL ENGINEERING

FOR M.E. STRUCTURAL ENGINEERING

(For the Students Admitted in the Academic Year 2021-2022 onwards)

FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSM101	Advanced Mathematics for Structural Engineering	FC	3	1	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100
21PST101	Applied Elasticity and Plasticity	PC	3	0	0	3	40	60	100
21PST102	Finite Element Analysis and Methods	PC	3	0	2	4	40	60	100
21PSE101	Experimental Techniques	PC	3	0	2	4	40	60	100
	Professional Elective – I	PE	3	0	0	3	40	60	100
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	–	100
TOTAL CREDITS IN SEMESTER – I			21						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PST201	Advances in Steel Structures	PC	3	0	0	3	40	60	100
21PST202	Structural Dynamics and Seismic Design	PC	3	0	0	3	40	60	100
21PSE201	Advances in Concrete Technology	PC	3	0	2	4	40	60	100
	Professional Elective – II	PE	3	0	0	3	40	60	100
	Professional Elective – III	PE	3	0	0	3	40	60	100
	Open Elective	OE	3	0	0	3	40	60	100
21PEE201	Mini Project	EEC	0	0	2	1	100	–	100
TOTAL CREDITS IN SEMESTER – II			20						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
	Professional Elective – IV	PE	3	1	0	4	40	60	100
	Professional Elective – V	PE	3	1	0	4	40	60	100
	Professional Elective – VI	PE	3	0	0	3	40	60	100
21PEE301	Project work (Phase – I)	EEC	0	0	12	6	40	60	100
TOTAL CREDITS IN SEMESTER – III			17						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE401	Project work (Phase – II)	EEC	0	0	24	12	40	60	100
TOTAL CREDITS IN SEMESTER – IV			12						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOUNDATION COURSES (FC)

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSM101	Advanced Mathematics for Structural Engineering	FC	3	1	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100

PROFESSIONAL CORE (PC)

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PST101	Applied Elasticity and Plasticity	PC	3	0	0	3	40	60	100
21PST102	Finite Element Analysis and Methods	PC	3	0	2	4	40	60	100
21PSE101	Experimental Techniques	PC	3	0	2	4	40	60	100
21PST201	Advances in Steel Structures	PC	3	0	0	3	40	60	100
21PST202	Structural Dynamics and Seismic Design	PC	3	0	0	3	40	60	100
21PSE201	Advances in Concrete Technology	PC	3	0	2	4	40	60	100

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE - I – SEMESTER I

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP101	Disaster Resistant Structures	PE	3	0	0	3	40	60	100
21PSP102	Theory of Structural Stability	PE	3	0	0	3	40	60	100
21PSP103	Advances in Concrete Structures	PE	3	0	0	3	40	60	100
21PSP104	Smart Materials for Construction	PE	3	0	0	3	40	60	100
21PSP105	Cracks and Crack Control in Concrete Structures	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - II – SEMESTER II

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP201	Formwork Engineering	PE	3	0	0	3	40	60	100
21PSP202	Design of Industrial Structures	PE	3	0	0	3	40	60	100
21PSP203	Structural Health Monitoring	PE	3	0	0	3	40	60	100
21PSP204	Fracture Mechanics	PE	3	0	0	3	40	60	100
21PSP205	Pre-stressed Concrete Structures	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - III – SEMESTER II

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP206	Structural Optimization	PE	3	0	0	3	40	60	100
21PSP207	Energy Efficient Structures	PE	3	0	0	3	40	60	100
21PSP208	Wind and Cyclone Effects on Structures	PE	3	0	0	3	40	60	100
21PSP209	Computer Aided Design of Structures	PE	3	0	0	3	40	60	100
21PSP210	Mechanics of Composite Materials	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE - IV – SEMESTER III

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP301	Design of Offshore Structures	PE	3	1	0	4	40	60	100
21PSP302	Design of Steel Concrete Composite Structures	PE	3	1	0	4	40	60	100
21PSP303	Design of Masonry Structures	PE	3	1	0	4	40	60	100
21PSP304	Non–Linear Analysis	PE	3	1	0	4	40	60	100
21PSP305	Bridge Structures	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE - V – SEMESTER III

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP306	Design of structures for Dynamic Loads	PE	3	1	0	4	40	60	100
21PSP307	Design of Shell and Spatial Structures	PE	3	1	0	4	40	60	100
21PSP308	Design of Sub–Structures	PE	3	1	0	4	40	60	100
21PSP309	Structural Analysis by Matrix Methods	PE	3	1	0	4	40	60	100
21PSP310	Cold Formed Steel Structures	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE - VI – SEMESTER III

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PSP311	Theory of Plates	PE	3	0	0	3	40	60	100
21PSP312	Soil Structure Interaction	PE	3	0	0	3	40	60	100
21PSP313	Corrosion Engineering	PE	3	0	0	3	40	60	100
21PSP314	Maintenance and Rehabilitation of Structures	PE	3	0	0	3	40	60	100
21PSP315	Smart Structures	PE	3	0	0	3	40	60	100

OPEN ELECTIVE – SEMESTER II

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PGO201	Disaster Management	OE	3	0	0	3	40	60	100
21PGO202	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
21PGO203	Constitution of India	OE	3	0	0	3	40	60	100
21PGO204	Business Analytics	OE	3	0	0	3	40	60	100
21PGO205	Digital Marketing	OE	3	0	0	3	40	60	100

CURRICULUM AND SYLLABI

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FOR M.E. VLSI DESIGN

(For the Students Admitted in the Academic Year 2021-2022 onwards)

FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVM101	Graph Theory and Optimization Techniques	FC	4	0	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100
21PVT101	Device Modeling	PC	3	0	0	3	40	60	100
21PVT102	System Design Using FPGA	PC	3	0	2	4	40	60	100
21PVE101	CMOS Digital VLSI Design	PC	3	0	2	4	40	60	100
	Professional Elective - I	PE	3	0	0	3	40	60	100
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	-	100
TOTAL CREDITS IN SEMESTER - I			21						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVT201	Testing of VLSI Circuits	PC	3	0	0	3	40	60	100
21PVT202	CAD for VLSI Circuits	PC	3	0	0	3	40	60	100
21PVE201	Analog IC Design	PC	3	0	2	4	40	60	100
	Professional Elective - II	PE	3	0	0	3	40	60	100
	Professional Elective - III	PE	3	0	0	3	40	60	100
	Open Elective - I	PE	3	0	0	3	40	60	100
21PEE201	Mini Project	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER - II			20						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
	Professional Elective - IV	PE	3	1	0	4	40	60	100
	Professional Elective - V	PE	3	1	0	4	40	60	100
	Professional Elective - VI	PE	3	0	0	3	40	60	100
21PEE301	Project Work Phase - I	EEC	0	0	12	6	40	60	100
TOTAL CREDITS IN SEMESTER - III			17						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE401	Project Work Phase - II	EEC	0	0	24	12	40	60	100
TOTAL CREDITS IN SEMESTER - IV			12						

FC : Foundation Courses,
PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOUNDATION COURSES (FC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVM101	Graph Theory and Optimization Techniques	FC	4	0	0	4	40	60	100
21PGT101	Research Methodology and IPR	FC	3	0	0	3	40	60	100

PROFESSIONAL CORE (PC)

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVT101	Device Modeling	PC	3	0	0	3	40	60	100
21PVT102	System Design Using FPGA	PC	3	0	2	4	40	60	100
21PVE101	CMOS Digital VLSI Design	PC	3	0	2	4	40	60	100
21PVT201	Testing of VLSI Circuits	PC	3	0	0	3	40	60	100
21PVT202	CAD for VLSI Circuits	PC	3	0	0	3	40	60	100
21PVE201	Analog IC Design	PC	3	0	2	4	40	60	100

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE - I – SEMESTER I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP101	Low Power VLSI Design	PE	3	0	0	3	40	60	100
21PVP102	DSP Integrated Circuits	PE	3	0	0	3	40	60	100
21PVP103	Physical Design of VLSI Circuits	PE	3	0	0	3	40	60	100
21PVP104	Advanced Computer Architecture and parallel Processing	PE	3	0	0	3	40	60	100
21PVP105	VLSI Technology	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- II – SEMESTER II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP201	VLSI Signal Processing	PE	3	0	0	3	40	60	100
21PVP202	Reconfigurable Architectures	PE	3	0	0	3	40	60	100
21PVP203	Design of Analog Filters and Signal Conditioning Circuits	PE	3	0	0	3	40	60	100
21PVP204	System on Chip Design	PE	3	0	0	3	40	60	100
21PVP205	Security Solutions in VLSI	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE- III – SEMESTER II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP206	Design of Semiconductor Memories	PE	3	0	0	3	40	60	100
21PVP207	Scripting Languages for VLSI	PE	3	0	0	3	40	60	100
21PVP208	Networks on Chip	PE	3	0	0	3	40	60	100
21PVP209	Signal Integrity for High Speed Design	PE	3	0	0	3	40	60	100
21PVP210	DSP Processor Architecture and Programming	PE	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE-IV – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP301	Mixed Signal VLSI Design	PE	3	1	0	4	40	60	100
21PVP302	Embedded System Design	PE	3	1	0	4	40	60	100
21PVP303	Soft Computing and Optimization Techniques	PE	3	1	0	4	40	60	100
21PVP304	VLSI for Biomedical Systems	PE	3	1	0	4	40	60	100
21PVP305	RF IC Design	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE-V – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP306	Hardware Verification Techniques	PE	3	1	0	4	40	60	100
21PVP307	VLSI for Wireless Communication	PE	3	1	0	4	40	60	100
21PVP308	ASIC Design	PE	3	1	0	4	40	60	100
21PVP309	Nano Scale Devices	PE	3	1	0	4	40	60	100
21PVP310	IP based VLSI Design	PE	3	1	0	4	40	60	100

PROFESSIONAL ELECTIVE-VI – SEMESTER III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PVP311	VLSI for IoT Systems	PE	3	0	0	3	40	60	100
21PVP312	VLSI Architecture for Image and Video Processing	PE	3	0	0	3	40	60	100
21PVP313	Hardware – Software Co-Design	PE	3	0	0	3	40	60	100
21PVP314	Selected Topics in IC Design	PE	3	0	0	3	40	60	100
21PVP315	MEMS and NEMS	PE	3	0	0	3	40	60	100

OPEN ELECTIVE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PGO201	Disaster Management	OE	3	0	0	3	40	60	100
21PGO202	Cost Management of Engineering Projects	OE	3	0	0	3	40	60	100
21PGO203	Constitution of India	OE	3	0	0	3	40	60	100
21PGO204	Business Analytics	OE	3	0	0	3	40	60	100
21PGO205	Digital Marketing	OE	3	0	0	3	40	60	100

M.B.A. DEGREE PROGRAMME

CURRICULUM AND SYLLABI

(For the Students admitted in the Academic Year 2021-2022 onwards)

FIRST SEMESTER

Course Code	Name of the Subject	Category	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21BAT101	Economic Analysis for Business	PC	4	0	0	4	40	60	100
21BAT102	Principles of Management	PC	3	0	0	3	40	60	100
21BAT103	Accounting for Management	PC	4	0	0	4	40	60	100
21BAT104	Legal Aspects of Business	PC	3	0	0	3	40	60	100
21BAT105	Organizational Behaviour	PC	3	0	0	3	40	60	100
21BAT106	Statistics for Management	PC	3	0	0	3	40	60	100
21BAT107	Total Quality Management	PC	3	0	0	3	40	60	100
21BAE101	Spoken and Written Communication	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER I			25						

PC : Professional Core,
PE : Professional Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

SECOND SEMESTER

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21BAT201	Applied Operations Research	PC	3	0	0	3	40	60	100
21BAT202	Business Research Methods	PC	3	0	0	3	40	60	100
21BAT203	Financial Management	PC	3	0	0	3	40	60	100
21BAT204	Human Resource Management	PC	3	0	0	3	40	60	100
21BAT205	Information Management	PC	3	0	0	3	40	60	100
21BAT206	Operations Management	PC	3	0	0	3	40	60	100
21BAT207	Marketing Management	PC	4	0	0	4	40	60	100
21BAL201	Data Analysis and Business Modeling	PC	0	0	4	2	40	60	100
21BAE201	Creativity and Innovation	EEC	0	0	2	0	100	-	100
TOTAL CREDITS IN SEMESTER II			24						

PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

THIRD SEMESTER

Course Code	Name of the Subject	Category	Hours Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21BAT301	International Business Management	PC	3	0	0	3	40	60	100
21BAT302	Strategic Management	PC	3	0	0	3	40	60	100
	Professional Elective I***	PE	3	0	0	3	40	60	100
	Professional Elective II***	PE	3	0	0	3	40	60	100
	Professional Elective III***	PE	3	0	0	3	40	60	100
	Professional Elective IV***	PE	3	0	0	3	40	60	100
	Professional Elective V***	PE	3	0	0	3	40	60	100
	Professional Elective VI***	PE	3	0	0	3	40	60	100
21BAE301	Summer Training	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER III			25						

***Chosen electives should be from two streams of management of three electives each.

PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

FOURTH SEMESTER

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21BAE401	Project Work	EEC	0	0	24	12	40	60	100
TOTAL CREDITS IN SEMESTER IV			12						

PC : Professional Core,
PE : Professional Elective,
OE : Open Elective,
EEC : Employability Enhancement Courses,
L : Lecture,
T : Tutorial,
P : Practical,
C : Credit Point,
CIA : Continuous Internal Assessment,
ESE : End Semester Examination,
TOT : Total

PROFESSIONAL CORE (PC)

Sl. No.	Course Code	Name of the Subject	CATEGORY	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CIA	ESE	TOT
1.	21BAT101	Economic Analysis for Business	PC	4	0	0	4	40	60	100
2.	21BAT102	Principles of Management	PC	3	0	0	3	40	60	100
3.	21BAT103	Accounting for Management	PC	4	0	0	4	40	60	100
4.	21BAT104	Legal Aspects of Business	PC	3	0	0	3	40	60	100
5.	21BAT105	Organizational Behaviour	PC	3	0	0	3	40	60	100
6.	21BAT106	Statistics for Management	PC	3	0	0	3	40	60	100
7.	21BAT107	Total Quality Management	PC	3	0	0	3	40	60	100
8.	21BAT201	Applied Operations Research	PC	3	0	0	3	40	60	100
9.	21BAT202	Business Research Methods	PC	3	0	0	3	40	60	100
10.	21BAT203	Financial Management	PC	3	0	0	3	40	60	100
11.	21BAT204	Human Resource Management	PC	3	0	0	3	40	60	100
12.	21BAT205	Information Management	PC	3	0	0	3	40	60	100
13.	21BAT206	Operations Management	PC	3	0	0	3	40	60	100
14.	21BAT207	Marketing Management	PC	4	0	0	4	40	60	100
15.	21BAT301	International Business Management	PC	3	0	0	3	40	60	100
16.	21BAT302	Strategic Management	PC	3	0	0	3	40	60	100
17	19BAL208	Data Analysis and Business Modeling	PC	0	0	4	2	40	60	100

PROFESSIONAL ELECTIVES (PE)

Sl. No.	Course Code	Name of the Subject	CATEGORY	Hours / Week			Credit	Maximum Marks		
				L	T	P	C	CIA	ESE	TOT
Stream/ Specialization : Marketing Management										
1.	21BATM01	Brand Management	PE	3	0	0	3	40	60	100
2.	21BATM02	Social Marketing	PE	3	0	0	3	40	60	100
3.	21BATM03	Customer Relationship Management	PE	3	0	0	3	40	60	100
4.	21BATM04	Integrated Marketing Communication	PE	3	0	0	3	40	60	100
5.	21BATM05	Retail Marketing	PE	3	0	0	3	40	60	100
6.	21BATM06	Services Marketing	PE	3	0	0	3	40	60	100
Stream/ Specialization : Financial Management										
1.	21BATF01	Strategic Investment and Financing Decisions	PE	3	0	0	3	40	60	100
2.	21BATF02	Corporate Finance	PE	3	0	0	3	40	60	100
3.	21BATF03	Derivatives Management	PE	3	0	0	3	40	60	100
4.	21BATF04	Merchant Banking and Financial Services	PE	3	0	0	3	40	60	100
5.	21BATF05	Security Analysis and Portfolio Management	PE	3	0	0	3	40	60	100
6.	21BATF06	International Trade Finance	PE	3	0	0	3	40	60	100
Stream/ Specialization : Human Resource Management										
1.	21BATH01	Entrepreneurship Development	PE	3	0	0	3	40	60	100
2.	21BATH02	Industrial Relations and Labour Welfare	PE	3	0	0	3	40	60	100
3.	21BATH03	Labour Legislations	PE	3	0	0	3	40	60	100
4.	21BATH04	Managerial Behaviour and Effectiveness	PE	3	0	0	3	40	60	100
5	21BATH05	Organizational Theory, Design and Development	PE	3	0	0	3	40	60	100
6	21BATH06	Strategic Human ResourceManagement	PE	3	0	0	3	40	60	100
Stream/ Specialization : **Systems Management**										
1.	21BATS01	Advanced Database ManagementSystem	PE	3	0	0	3	40	60	100
2.	21BATS02	Data mining for Business Intelligence	PE	3	0	0	3	40	60	100
3.	21BATS03	Enterprise Resource Planning	PE	3	0	0	3	40	60	100
4.	21BATS04	Software Project Management and Quality	PE	3	0	0	3	40	60	100
5.	21BATS05	E-Business Management	PE	3	0	0	3	40	60	100

Stream/ Specialization : Operations Management										
1.	21BATO01	Logistics Management	PE	3	0	0	3	40	60	100
2.	21BATO02	Materials Management	PE	3	0	0	3	40	60	100
3.	21BATO03	Product Design	PE	3	0	0	3	40	60	100
4.	21BATO04	Project Management	PE	3	0	0	3	40	60	100
5.	21BATO05	Services Operations Management	PE	3	0	0	3	40	60	100
6.	21BATO06	Supply Chain Management	PE	3	0	0	3	40	60	100
Stream/ Specialization : Healthcare Management										
1.	21BATH11	Fundamentals of Healthcare Administration	PE	3	0	0	3	40	60	100
2.	21BATH12	Healthcare Planning, Design & Maintenance	PE	3	0	0	3	40	60	100
3.	21BATH13	Hospital Front Office Management	PE	3	0	0	3	40	60	100
4.	21BATH14	Hospital Waste Management	PE	3	0	0	3	40	60	100
5.	21BATH15	Health Care Laws & Ethics	PE	3	0	0	3	40	60	100
6.	21BATH16	Healthcare Support Services	PE	3	0	0	3	40	60	100
Stream/ Specialization : Logistics and Supply Chain Management										
1.	21BATL01	Supply Chain Concepts and Planning	PE	3	0	0	3	40	60	100
2.	21BATL02	Warehouse Management	PE	3	0	0	3	40	60	100
3.	21BATL03	Transportation and Distribution Management	PE	3	0	0	3	40	60	100
4.	21BATL04	Reverse and Contract Logistics	PE	3	0	0	3	40	60	100
5.	21BATL05	Supply Chain Information System	PE	3	0	0	3	40	60	100
6.	21BATL06	Exim Management	PE	3	0	0	3	40	60	100
Stream/ Specialization : Infrastructure and Real Estate Management										
1.	21BATI01	Infrastructure Planning, Scheduling and Control	PE	3	0	0	3	40	60	100
2.	21BATI02	Project Management For Infrastructure	PE	3	0	0	3	40	60	100
3.	21BATI03	Urban Environment Management	PE	3	0	0	3	40	60	100
4.	21BATI04	Real Estate Marketing And Management	PE	3	0	0	3	40	60	100
5.	21BATI05	Disaster Mitigation and Management	PE	3	0	0	3	40	60	100
6.	21BATI06	Valuation of Real Estate And Infrastructure Assets	PE	3	0	0	3	40	60	100

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

SEMESTER I

21PCM101 APPLIED MATHEMATICS FOR COMPUTER SCIENCE LT PC 3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Test the hypothesis about the population usingt,f and Chi-square test.
- Acquire knowledge ofanalysis of variance.
- Provide information about Estimation theory and Regression lines.
- Develop logical thinking and knowledge on how discrete structures actually helped computer engineers to solve problems occurred in the development of programming languages.
- Develop theoretical knowledge and understanding of graph theory.

UNIT I : TESTING OF HYPOTHESIS 9+3

Sampling distribution – Sample and large samples – Test based on normal,t- test,Chi-square and F-distribution for testing mean, variance and proportions -test for goodness of fit – Independence of attributes.

UNIT II : DESIGN OF EXPERIMENTS 9+3

Analysis of vaiance – one way classification – Completely randomised design – Two way classification – Randomised block design– Latin square design.

UNIT III : ESTIMATION THEORY 9+3

Unbiased estimators – Method of moments – Maximum likelihood estimation – Curve fitting by principles of least squares – Regression lines.

UNIT IV : PROPOSITIONAL AND PREDICATE CALCULUS 9+3

Propositional Logic –Applications of Propositional Logic – Propositional Equivalences – Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

UNIT V : GRAPHS AND TREES 9+3

Graphs and Graphs Models– Graph Terminology and Special Types of Graph– MatrixRepresentation of Graphs– Shortest Path Problems – Planar Graphs – Graph Coloring – Inrtoduction to trees – Properties of Trees –Spanning Trees – Minimum Spanning Trees.

TOTAL : 45+15= 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Find the inference of the samples by using various methods in testing of hypothesis.
- Interpret variances by design of experiments to obtain inferences.
- Use the concept of Estimation theory.
- Apply logical thinking and its applications to computer science.
- Conceptualize sequential structures, tree structures, and graph structures and its applications.

TEXT BOOKS

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Kenneth H.Rosen, K.H., "Discrete Mathematics and its Applications" McGraw Hill Education (India), Private Limited,New Delhi, Special Indian Edition,2011.

REFERENCES

1. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Statistics and Numerical Methods", S. Chand and Company Ltd., NewDelhi, 2010.
2. Tremblay,J.P and Manohar.R, "Discrete Mathematical Structures with Applications to ComputerScience", Tata McGraw Hill Publishing Company Limited,New Delhi, 30th Reprint,2011

E-RESOURCES

1. https://nptel.ac.in/courses/110/107/110107114/ (Testing of Hypothesis)
2. https://nptel.ac.in/courses/111/106/111106102/ (Propositional Calculus)

21PGT101 **RESEARCH METHODOLOGY AND IPR** **L T P C**
(Common to all PG Engineering Courses) **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Identify problem formulation, analysis and solutions.
- Know the effective literature study approaches.
- Write Technical papers / presentations without violating professional ethics.
- Understand the process of process and procedure of patenting.
- Gain basic knowledge on intellectual property rights.

UNIT I: RESEARCH PROBLEM **9**

Meaning of research problem – Sources of research problem – Criteria characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem – Approaches of investigation of solutions for research problem – Data collection – Analysis – Interpretation – Necessary instrumentations

UNIT II: LITERATURE REVIEW **9**

Effective literature studies approaches – Analysis – Plagiarism and research ethics.

UNIT III: TECHNICAL WRITING /PRESENTATION **9**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee**.**

UNIT IV: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Nature of Intellectual Property – Patents, Designs – Trade and Copyright – Process of Patenting and Development: technological research – Innovation, patenting, development – International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents, Patenting under PCT.

UNIT V: INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications – New Developments in IPR: Administration of Patent System – IPR of Biological Systems, Computer Software etc – Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Formulate research problems.
- Carry out research analysis.
- Write technical papers/presentations.
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow the world will be ruled by ideas, concepts, and creativity.
- Understand about IPR and filing patents in R & D.

TEXT BOOKS

1. Ranjith Kumar, "Research Methodology: A step–by–step guide for beginners", SAGE Publications, 4th Edition, 2014.
2. Neeraj Pandey, Khushdeep Dhrani, "Intellectual Property Rights", PHI Learning Private Limited, 2014.

REFERENCES

1. Heather Silyn–Roberts, "Writing for Science and Engineering: Papers, Presentations and Reports", Elsevier, 2nd Edition, 2013.
2. Douglas C. Montgomery, "Design and Analysis of Experiments", 9th Edition, Wiley Publishers, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/121/106/121106007/ (Introduction to Research)
2. https://nptel.ac.in/courses/109/106/109106137/ (IPR)

21PCT101 MACHINE LEARNING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce the basic concepts and techniques of machine learning.
- Discuss the neural network algorithms.
- Understand the concept of genetic algorithms for machine learning techniques.
- Learn the learning set of rules.
- Understand the graphical models of machine learning algorithms.

UNIT I : INTRODUCTION 9

Introduction – Designing a Learning System – Perspectives and issues in Machine Learning – A Concept Learning Task – Version Spaces and the Candid Elimination Algorithm – Inductive bias – Decision Tree learning – Inductive bias in Decision Tree Learning – Issues in Decision Tree Learning.

UNIT II: NEURAL NETWORKS 9

Neural Network Representations – perceptrons – Multilayer and Backpropogation Algorithm – An Illustrative Examples:Face Recognition – Advanced Topics in Artificial Neural Networks**.**

UNIT III : GENETIC ALGORITHMS 9

Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning – Parallelizing Genetic Algorithms.

UNIT IV : LEARNING SET OF RULES 9

Introduction – Sequential Covering Algorithms – Learning First-Order Rules – learning Sets of First-Order Rules:FOIL – Induction as Inverted Deduction – Inverting Resolution.

UNIT V : GRAPHICAL MODELS 9

Introduction – Geberative Models – d-Separation – Belief Propogation – Learning the Structure of Graphical Models – Hidden Markov Model.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Study the software architecture and its quality attributes.
- Discuss and apply backpropogation algorithm for machine learning applications.
- Discuss the genetic algorithms for various problems.
- Suggest set of rules for machine learning.
- Design systems that uses appropriate graph models of machine learning.

TEXT BOOKS

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", 3rd Edition, MIT Press, 2014.

REFERENCES

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.
2. Jason Bell, "Machine learning – Hands on for Developers and Technical Professionals", 1st Edition, Wiley, 2014.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105152/ (Different Types of Learning)
2. https://nptel.ac.in/courses/106/106/106106202/ (Learning Problem)

21PCT102 **WEB ENGINEERING** **L T P C**
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Understand the characteristics of web applications
- Learn to Model web applications
- Be aware of Systematic design methods
- Be familiar with the testing techniques for web applications
- Develop and promote web applications.

UNIT I : INTRODUCTION TO WEB ENGINEERING **9**

Motivation, Categories of Web Applications, Characteristics of Web Applications. Requirements of Engineering in Web Applications- Web Engineering-Components of Web Engineering-Web Engineering Process-Communication-Planning.

UNIT II : WEB APPLICATION ARCHITECTURES & MODELLING WEB APPLICATIONS **9**

Introduction- Categorizing Architectures- Specifics of Web Application Architectures, Components of a Generic Web Application Architecture- Layered Architectures, 2-Layer Architectures, N-Layer Architectures-Data-aspect Architectures, Database-centric Architectures- Architectures for Web Document Management- Architectures for Multimedia Data- Modeling Concepts-Modeling languages- Analysis Modeling for Web Apps-The Content Model-The Interaction Model-Configuration Model.

UNIT III : WEB APPLICATION DESIGN **9**

Design for WebApps- Goals-Design Process-Interactive Design- Principles and Guidelines-Workflow-Preliminaries-Design Steps- Usability- Issues- Information Design- Information Architecture- structuring- Accessing Information-Navigation Design- Functional Design-Wep App Functionality- Design Process- Functional Architecture- Detailed Functional Design.

UNIT IV : TESTING WEB APPLICATIONS **9**

Introduction-Fundamentals-Test Specifics in Web Engineering-Test Approaches- Conventional Approaches, Agile Approaches- Testing concepts- Testing Process -Test Scheme- Test Methods and Techniques- Link Testing- Browser Testing-Usability Testing- Load, Stress, and Continuous Testing, Testing Security, Test-driven Development, -Content Testing-User Interface testing-Usability Testing-Compatibility Testing-Component Level Testing-Navigation Testing-Configuration testing-Security and PerformanceTesting-TestAutomation.

UNIT V : PROMOTING WEB APPLICATIONS AND WEB PROJECT MANAGEMENT 9

Introduction-challenges in launching the web Application-Promoting Web Application- Content Management-Usage Analysis-Web Project Management-Challenges in Web Project Management-Managing Web Team- Managing the Development Process of a Web Application-Risk, Developing a Schedule, Managing Quality, Managing Change, Tracking the Project. Introduction to node JS – web sockets.

LIST OF EXPERIMENTS

1. Write a program in Java Script for the following:
   - Copying, passing, and comparing by value
   - Copying, passing, and comparing by reference
   - References themselves are passed by value
2. Write program in Java Script for pattern matching using regular expressions and errors in scripts.
3. Analyze the designing of a web page with various cascading style sheets.
4. Design a web application to calculate the celcius to farhenheit.
5. Test theWeb Application to check for the proper functioning.

TOTAL : 45+15= 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Explain the characteristics of web applications.
- Model web applications.
- Design web applications.
- Test web applications.
- Be aware of Systematic design methods.

TEXT BOOKS

1. Chris Bates, "Web Programming: Building Internet Applications", 3rdEdition, Wiley India Edition, 2007.
2. Gerti Kappel, Birgit Proll, "Web Engineering", John Wiley and Sons Ltd, 2006.

REFERENCES

1. Guy W. Lecky-Thompson,"Web Programming", Cengage Learning, 2008.
2. John Paul Mueller,"Web Development with Microsoft Visual Studio 2005", Wiley Dream tech, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106156/ (Web Architecture)
2. https://www.digimat.in/nptel/courses/video/106101163/L47.html (Introduction to Web Engineering)

21PCE101 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Understand the usage of algorithms in computing.
- Learn and use hierarchical data structures and its operations
- Learn the usage of graphs and its applications.
- Select and design data structures and algorithms that is appropriate for problems.
- Analyze the NP problems.
- Apply various algorithms in programming.

UNIT I : ROLE OF ALGORITHMSIN COMPUTING **9**

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method

UNIT II : HIERARCHICAL DATASTRUCTURES **9**

Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B- trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node- Bounding the maximum degree.

UNIT III : GRAPHS **9**

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra's Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm;

UNIT IV : ALGORITHM DESIGN TECHNIQUES **9**

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- HuffmanCodes.

UNIT V : NP COMPLETE AND NP HARD **9**

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems.

LIST OF EXPERIMENTS

1. Implementation of Merge Sort and QuickSort-Analysis
2. Implementation of a Binary SearchTree
3. GraphTraversals
4. Spanning TreeImplementation
5. Shortest Path Algorithms (Dijkstra's algorithm, Bellmann FordAlgorithm)
6. Activity Selection and Huffman CodingImplementation.

TOTAL : 45+15= 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Design data structures and algorithms to solve computing problems.
- Design algorithms using graph structure and various string matching algorithms to solve real-life problems.
- Apply suitable design strategy for problem solving.
- Select and design data structures and algorithms that is appropriate for problems.
- Analyze the NP problems.
- Apply various algorithms in programming.

TEXT BOOKS

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman,"Data Structures and Algorithms", Pearson Education, Reprint 2006.
2. Robert Sedgewick and Kevin Wayne, "ALGORITHMS", 4th Edition, Pearson Education,2011.

REFERENCES

1. S.Sridhar,"Design and Analysis of Algorithms", 1st Edition, Oxford University Press. 2014.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice-Hall, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106131/ (Introduction to Data Structures)
2. https://nptel.ac.in/courses/106/104/106104019/ (Trees, Graphs)

21PEE101 RESEARCH PAPER WRITING AND SEMINAR L T P C
1 0 0 0

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers).
4. Preparing a draft outline of research work.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Linking the papers and preparing a draft of the paper.
7. Preparing conclusions based on the reading of all the papers.
8. Writing the Final Paper and giving final Presentation.
9. Maintaining a file for records of activities.

Activities to be carried out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	1. Select an area of interest and topic. 2. State the objectives.	2nd week	**3%** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about the area & topic	1. List one special interest groups or professional society. 2. List two journals. 3. List two conferences, symposia or workshops. 4. List one thesis title. 5. List three web presences (mailing lists,forums,news sites) 6. List three authors who publish regularly in the area 7. Attach a call for papers(CFP) from the area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)

Collection of Journal papers in the topic in the context of the objective - collect 20 & then filter	• Provide a complete list of references based on the objectives • Search various digital libraries and Google Scholar • Collect recent papers related to research area so that to write a meaningful survey out of them, • Do a recent survey of the field. • Find relationships of base paper with respect to other literature concerned. (classification scheme / categorization). • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered.	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research?	5th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)

	• What did the author say were the important directions for future research? Conclude with limitations/issues not addressed by the paper (from the perspective of the survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft outline for survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)

Sections of the paper	Write the sections of the paper based on the classification / categorization diagram in keeping with the goals of the survey.	11th week	**10%**(this component will be evaluated based on the linking and classification amongthe papers)
Conclusions	Write conclusions and future work.	12th week	**5%** (conclusions – clarity and ideas)
Final Draft	Complete the final draft of the paper.	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	Prepare for Final Presentation.	14th& 15th week	**10%** (based on presentation and viva-voce)

TOTAL: 30 PERIODS

SEMESTER II

21PCT201 ADVANCED SOFT COMPUTING L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn the basic concepts of SoftComputing.
- Become familiar with various techniques like neural networks.
- Geneticalgorithms and fuzzysystems.
- Apply soft computing techniques to solve problems.
- Understand the genetic representations.

UNIT I : INTRODUCTION TO SOFT COMPUTING 9

Introduction – Artificial Intelligence – Artificial Neural Networks – Fuzzy Systems – Genetic Algorithm and Evolutionary Programming – Swarm Intelligent Systems – Classification of ANNs – McCulloch and Pitts Neuron Model – Learning Rules: Hebbian and Delta – Perceptron Network – Adaline Network – Madaline Network.

UNIT II : ARTIFICIAL NEURAL NETWORKS 9

Introduction – Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks, back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting backpropagation training, applications.

UNIT III : FUZZY SYSTEMS 9

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion – Membership functions, interference in fuzzy logic, fuzzy if–then rules, Fuzzy implications and Fuzzy algorithms.

UNIT IV : GENETIC ALGORITHMS 9

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

UNIT V : HYBRID SYSTEMS 9

Hybrid Systems – Neural Networks, Fuzzy Logic and Genetic – GA Based Weight Determination – LR-Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP – Inference by Fuzzy BP – Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools – GA in Fuzzy Logic Controller Design – Fuzzy Logic Controller – Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Apply suitable soft computing techniques for variousapplications.
- Integrate various soft computing techniques for complex problems.
- Analyze and integrate various soft computing techniques.
- Solve problems effectively and efficiently.
- Parameterize various problems to be solved.

TEXT BOOKS

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming" , Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro - Fuzzy and Soft Computing", Prentice-Hall of India, 2002.
2. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2005.

E–RESOURCES

1. https://nptel.ac.in/courses/106/105/106105173/ (Introduction to Soft computing)
2. https://www.digimat.in/nptel/courses/video/106105173/L01.html(Computing Techniques)

21PCT202 **INDUSTRIAL IoT** **L T P C**
3 0 0 3

OBJECTIVES:

The main objective of this course is to:

- Understand the fundamentals of Internet ofThings.
- Learn about the basics of IOTprotocols.
- Build a small low cost embedded system using RaspberryPi.
- Apply the concept of Internet of Things in the real worldscenario.
- Study various usecases in industries.

UNIT I : INTRODUCTION TO IoT **9**

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

UNIT II : IoT ARCHITECTURE **9**

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT referencemodel - Domain model - information model - functional model - communication model - IoT reference architecture.

UNIT III : IoT PROTOCOLS **9**

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security.

UNIT IV : BUILDING IoT WITH RASPBERRY PI&ARDUINO **9**

Building IOT with RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

UNIT V : CASE STUDIES AND REAL - WORLD APPLICATIONS **9**

Real world design constraints - Applications - Asset management, Industrial automation, smart grid,Commercialbuildingautomation,Smartcities – participatorysensing-Amazon Web Services for IoT.Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Analyze various protocols forIoT.
- Develop web services to access/control IoTdevices.
- Design a portable IoT using RasperryPi.
- Deploy an IoT application and connect to thecloud.
- Analyze applications of IoT in real timescenario.

TEXT BOOKS

1. Arshdeep Bahga, Vijay Madisetti,"Internet of Things – A hands-on approach", Universities Press, 2015.
2. "Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress),2016.

REFERENCES

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", CRC Press, 2012.
2. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence", Elsevier, 2014.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105166/(Introduction to IoT)
2. https://onlinecourses.swayam2.ac.in/arp19_ap52/preview (IoT Protocols)

21PCE201 **DATA SCIENCE AND ANALYTICS** **L T P C**
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Understandthebasics of Data Science.
- Learndifferentconventional data analytics tools.
- Know the advanced analytical theory and methods.
- Learn data analytics using Python.
- Learn exploratory data analytics using Python.
- Solve various problems in Data Science.

UNIT I:INTRODUCTION **9**

Introduction of Data Science – Basic Data Analytics using R – R Graphical User Interfaces – Data Import and Export – Attribute and Data Types – Descriptive Statistics – Exploratory Data Analysis – Visualization Before Analysis – Dirty Data – Visualizing a Single Variable – Examining Multiple Variables – Data Exploration Versus Presentation.

UNIT II:CONVENTIONAL DATA ANALYTICS TOOLS **9**

Analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, and prediction error. Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods.

UNIT III:ADVANCED ANALYTICAL THEORY AND METHODS **9**

Overview of Clustering – K-means – Use Cases – Overview of the Method – Perform a K-means Analysis using R – Classification – Decision Trees – Overview of a Decision Tree – Decision Tree Algorithms – Evaluating a Decision Tree – Decision Tree in R – Bayes' Theorem – Naïve Bayes Classifier – Smoothing – Naïve Bayes in R.

UNIT IV:DATA ANALYTICS USING PYTHON **9**

Understanding the Data- Python Packages for Data Science- Importing and Exporting Data in Python - Importing Datasets for Python- Data Wrangling-Pre-processing Data in Python- Dealing with Missing Values in Python -Data Formatting in Python- Data Normalization in Python.- Binning in Python. -Turning categorical variables into quantitative variables in Python.

UNIT V:EXPLORATORY DATA ANALYTICS USING PYTHON **9**

Exploratory Data Analysis -Descriptive Statistics- GroupBy in Python- Data correlation in pythonCorrelation Statistics -Analysis of Variance (ANOVA). Linear Regression and Multiple

Linear RegressionModel Evaluation using Visualization- Polynomial Regression and Pipelines - Measures for In-Sample Evaluation -Model Development and applications.

LIST OF EXPERIMENTS

1. Introduction to R tool for for Data Science.
2. K-means Clustering.
3. Linear and Logistic Regression.
4. Sending Emails with Python.
5. Implement Sentiment analysis using Python.
6. Sample Data analysis using Python and R.

TOTAL:45+15= 60PERIODS

OUTCOMES

After completing this course, students should be able to:

- Studytheimportance of Data Science.
- Usedifferent tools and techniques for analysis.
- Study Classification and Clustering methods.
- Solve data analytical problems using Python.
- Solve exploratory data analytical problems using Python.
- Do sentiment analysis using python and R.

TEXTBOOKS

1. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data",1st Edition, Kindle Edition,2015.
2. Anand Rajaraman and Jeffrey David Ullman,"Mining of Massive Datasets", 3rd Edition, Cambridge University Press, 2020.

REFERENCES

1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jiawei Han, MichelineKamber "Data Mining Concepts and Techniques", 2nd Edition, Elsevier, 2008.

E–RESOURCES

1. https://nptel.ac.in/courses/106/106/106106179/ (Variables and Data Types in R)
2. https://nptel.ac.in/courses/106/107/106107220/ (Python Demo for Distributions)

21PEE201 **MINI PROJECT** **L T P C**
0 0 2 1

OBJECTIVES

The main objective of this course is to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Utilize new tools,algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project reports and to face reviews and viva-voce examination.

GUIDELINES

The studentworks on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor.The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.The project work is evaluated based on oral presentation and the project report jointly by the Project Coordinator and internal examiner constituted by the Head of the Department.

TOTAL: 30 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Test and validate the results obtained through conformance.
- Prepare project reports and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology.

SEMESTER - III

21PEE301	**PROJECT WORKPHASE – I**	**L T P C** **0 0 12 6**

OBJECTIVES

The main objective of the course is to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Analyze the problem statement with respect to the solutions.
- Design a methodology to resolve the identified problem.

GUIDELINES

The student works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor.The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 180 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of articles.
- Develop the skills to formulate a technical project.
- Analyze the problem statement with respect to the solutions.
- Design the methodology to resolve the identified problem.

SEMESTER - IV

21PEE401	PROJECT WORKPHASE – II	L T P C 0 0 24 12

OBJECTIVES

The main objective of the course is to:

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- Utilize new tools,algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Develop the ability to take up the challenging practical problems.

GUIDELINES

The student works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor.The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 360 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Develop the ability to solve a specific problem till the successful solution of the same.
- Utilize new tools,algorithms and mechanisms that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology.

SEMESTER I

PROFESSIONAL ELECTIVE - I

21PCP101 ADVANCED DATABASES L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Comprehend the various database revolution.
- Work with NoSQL databases to analyze the big data for useful business.
- Analyze the different data models based on data representation methods and storage needs.
- Design and develop using application programming interface with SQL and NoSQL databases.
- Discover the survey on future generation databases.

UNIT I : INTRODUCTION 9

Database Revolutions- System Architecture- Relational Database- Database Design Data Storage- Transaction Management- Data warehouse and Data Mining- Information Retrieval

UNIT II : DOCUMENT DATABASES 9

Big Data Revolution- CAP Theorem- Birth of NoSQL- Document Database—XML Databases- JSON Document Databases- Graph Databases. Column Databases— Data Warehousing Schemes- Columnar Alternative- Sybase IQ- C-store and Vertica- Column Database Architectures- SSD and In-Memory Databases— In Memory Databases- Berkeley Analytics Data Stack and Spark.

UNIT III : DISTRIBUTED DATABASE PATTERNS 9

Distributed Relational Databases- Non-relational Distributed Databases- MongoDB - Sharing and ReplicationHBase- Cassandra Consistency Models— Types of Consistency- Consistency MongoDB- HBase ConsistencyCassandra Consistency.

UNIT IV : DATA MODELS AND STORAGE 9

SQL- NoSQL APIs- Return SQL- Advance Databases-PostgreSQL- Riak-HBase-MongoDB-Cassandra Query Language-MapReduce-Pig-DAG-Cascading-Spark- CouchDB- NEO4J-Redis.

UNIT V : FUTURE DATABASE 9

Database of Future-Key value database-Distrubutive transaction-Other Convergent Databases-Disruptive Database Technologies-Storage Technologies – BlockChain-Quantum Computing.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- The students will be able to Comprehend the various database revolution.
- Work with NoSQL databases to analyze the big data for useful business.
- Applications Analyze the different data models based on data representation methods and storage needs.
- Design and develop using application programming interface with SQL and NoSQL databases.
- Discover the survey on future generation databases.

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 7th Edition, McGrawHill, 2019
2. Guy Harrison, "Next Generation Databases", Apress, 2015.

REFERENCES

1. Eric Redmond, Jim R Wilson, "Seven Databases in Seven Weeks", LLC. 2012
2. Dan Sullivan, "NoSQL for Mere Mortals", Addison-Wesley, 2015.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106093/ (Introduction to Database Management System)
2. https://nptel.ac.in/courses/106/104/106104021/ (Indexing and searching)

21PCP102 AGILE SOFTWARE DEVELOPMENT AND USABILITY ENGINEERING L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Understand the genesis of Agile and driving forces for choosing Agile techniques.
- Comprehend the Agile Scrum framework and development practices.
- Assess the software product using Agile testing methodologies and perform testing and activities within an agile project.
- Apply software design principles and refactoring techniques to achieve agility.
- Understand the business value for adopting agile software development.

UNIT I : FUNDAMENTALS OF AGILE 9

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

UNIT II : AGILE SCRUM FRAMEWORK 9

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management

UNIT III : AGILE TESTING 8

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

UNIT IV : AGILE SOFTWARE DESIGN AND DEVELOPMENT 10

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

UNIT V : INDUSTRY TRENDS **9**

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Explain the genesis of Agile and driving forces for choosing Agile techniques.
- Comprehend the Agile Scrum framework and development practices.
- Assess the software product using Agile testing methodologies and perform testing activities within an agile project.
- Apply software design principles and refactoring techniques to achieve agility.
- Evaluate the agile approach impact on cutting-edge technologies and also realize the business value for adopting agile software development.

TEXT BOOKS

1. Ken Schwaber, Mike Beedle, "Agile Software Development with Scrum", Pearson, 2014.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices" Pearson, 2003.

REFERENCES

1. Lisa Crispin, Janet Gregory," Agile Testing: A Practical Guide for Testers and Agile Teams" Addison Wesley, 2008.
2. Alistair Cockburn," Agile Software Development: The Cooperative Game" Addison Wesley, 2nd Edition, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/106/101/106101061/ - (Introduction to Software Engineering)
2. https://lecturenotes.in/s/1421-agile-software-development/videos - (Agile Methodology)

21PCP103 IMAGE PROCESSING AND ANALYSIS L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Discusses about basics of digital images.
- Analyze various types of filters.
- Steps involved in the analysis of an image viz., segmentation and edge detection.
- Examine the morphological operations.
- Discuss the texture analysis and compression techniques.

UNIT I : SPATIAL DOMAIN PROCESSING 9

Introduction to digital image processing - Fundamental Steps - Components – imaging modalities – image file formats – image sensing and acquisition – image sampling and quantization – noise models – spatial filtering operations – histograms – smoothing filters – sharpening filters – fuzzy techniques for spatial filtering – spatial filters for noise removal.

UNIT II : FREQUENCY DOMAIN PROCESSING 9

Frequency domain – Review of Fourier Transform (FT), Discrete Fourier Transform (DFT), and Fast Fourier Transform (FFT) – filtering in frequency domain – image smoothing – image sharpening – selective filtering – frequency domain noise filters.

UNIT III : SEGMENTATION AND EDGE DETECTION 9

Thresholding techniques – region growing methods – region splitting and merging – adaptive thresholding – threshold selection – global valley – histogram concavity – edge detection – template matching – gradient operators – circular operators – differential edge operators – hysteresis thresholding – Canny operator – Laplacian operator – active contours – object segmentation.

UNIT IV : INTEREST POINTS, MORPHOLOGY AND TEXTURE 9

Corner and interest point detection – template matching – second order derivatives – median filter based detection – Harris interest point operator – corner orientation – local invariant feature detectors and descriptors – morphology – dilation and erosion – morphological operators – grayscale morphology – noise and morphology.

UNIT V : COLOR IMAGES AND IMAGE COMPRESSION **9**

Color models – pseudo colors – full-color image processing – color transformations – smoothing and sharpening of color images – image segmentation based on color – noise in color images. Image Compression – redundancy in images – coding redundancy – irrelevant information in images – image compression models – basic compression methods : Huffman Coding, Golomb Coding – digital image watermarking.

TOTAL: 45PERIODS

OUTCOMES

After completing this course, students should be able to:

- Explain image modalities, sensing, acquisition, sampling, and quantization.
- Implement spatial and frequency domain transformations.
- Apply segmentation algorithms and edge detection techniques.
- Implement corner and interest point detection algorithms and apply morphological operations.
- Analyze colour images and implement image compression algorithms.

TEXT BOOKS

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", 3rd Edition, Pearson, 2008.
2. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.

REFERENCES

1. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for Computer Vision", 3rd Edition, Academic Press, 2012.
2. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.

E-RESOURCES

1. http://nptel.ac.in/courses/106105032/ (Digital Image Processing Introduction)
2. https://nptel.ac.in/courses/117/105/117105135/ (Point Detection Algorithms)

21PCP104 MOBILE APPLICATION DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Understand system requirements for mobile applications.
- Generate suitable design using specific mobile development frameworks.
- Generate mobile application design.
- Implement the design using specific mobile development frameworks.
- Deploy the mobile applications in marketplace for distribution.

UNIT I : INTRODUCTION 5

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.

UNIT II : BASIC DESIGN 8

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III : ADVANCED DESIGN 8

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV : ANDROID 12

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V : IOS 12

Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

TOTAL:45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Describe the requirements for mobile applications.
- Explain the challenges in mobile application design and development.
- Develop design for mobile applications for specific requirements.
- Implement the design using Android SDK.
- Implement the design using Objective C and iOS.

TEXT BOOKS

1. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012.

2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

REFERENCES

1.Reto Meier, "Professional android Development", Wiley-India Edition, 2012.

2. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106156/ (Introduction to Modern Application Development)
2. https://nptel.ac.in/courses/106/106/106106222/ (Mobile Application Development)

21PCP105 CLOUD SERVICES AND VIRTUALIZATION L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Familiarize with the types of virtualization.
- State the concept of cloud and utility computing.
- Analyze the various cloud platforms an the need for cloud security.
- Familiarize with the cloud programming model.
- Appreciate the emergence of cloud as the next generation computing paradigm and the need for cloud security.

UNIT I : CLOUD INFRASTRUCTURE 9

Scalable Computing over the Internet – Technologies for Network based Systems - System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture- Cloud Computing and Services Model – Public, Private and Hybrid Clouds – Cloud Eco System - IaaS - PaaS – SaaS.

UNIT II : VIRTUALIZATION STRUCTURES 9

Implementation Levels of Virtualization - Virtualization Structures – Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource Management – Virtualization for Data-Center Automation.

UNITIII : CLOUD SYSTEM MODEL 9

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Public Cloud Platforms- GAE, AWS, and Azure- Inter Cloud Resource Management – VM Management - Resource Provisioning and Platform Deployment - Global Exchange of Cloud Resources - Cloud Security and Trust Management.

UNIT IV : CLOUD SECURITY - MIDDLEWARE AND TESTING 9

Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments - Eucalyptus, Open Nebula, OpenStack. CloudSim – Architecture - Cloudlets – VM creation – Broker – VM allocation – Hosts – Data Center.

UNIT V : CLOUD APPLICATIONS AND CASE STUDIES **9**

Cloud Computing Risk Issues – Cloud Computing Security Challenges – Cloud Computing Security Architecture – Trusted cloud Computing – Identity Management and Access Control – Autonomic Security. Dynamic Resource Allocation Using Virtual Machines for Cloud Computing Environment.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Apply virtualization for efficient resource utilization.
- Explore cloud computing models and services
- Apply cloud platforms for different applications.
- Implement various services using cloud programming models.
- Interpret the security and resource allocation issues of cloud computing.

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security – A comprehensive Guide to Secure Cloud Computing", Wiley – India, 2010

REFERENCES

1. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation,Management, and Security", CRC Press, 2010.
2. Rajkumar Buyya, Christian Vecchiola, S.Tamarai Selvi, "Mastering Cloud Computing",TMGH,2013.

E-RESOURCES

1. https://nptel.ac.in/courses/106/104/106104182/ (Cloud Computing and Distributed Systems)
2. https://nptel.ac.in/courses/106/105/106105167/ (Cloud Computing)

SEMESTER II

PROFESSIONAL ELECTIVE - II

21PCP201 REAL TIME SYSTEMS L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Learn the real time operating system concepts, the associated issues and Techniques.
- Analysis the Software Requirement Engineering Process.
- Design and synchronization problems in Real Time System.
- Explore the concepts of real time databases.
- Examine the evaluation techniques present in Real Time System.

UNIT I : REAL TIME SYSTEM AND SCHEDULING 9

Introduction– Structure of a Real Time System –Task classes – Performance Measures for Real Time Systems – Estimating Program Run Times – Issues in Real Time Computing – Task Assignment and Scheduling – Classical uniprocessor scheduling algorithms –Fault Tolerant Scheduling.

UNIT II : SOFTWARE REQUIREMENTS ENGINEERING 9

Requirements engineering process – types of requirements – requirements specification for real time systems – Formal methods in software specification – structured Analysis and Design – object oriented analysis and design and unified modelling language – organizing the requirements document – organizing and writing documents – requirements validation and revision.

UNIT III : INTERTASK COMMUNICATION AND MEMORY MANAGEMENT 9

Buffering data – Time relative Buffering- Ring Buffers – Mailboxes – Queues – Critical regions – Semaphores – other Synchronization mechanisms – deadlock – priority inversion – process stack management – run time ring buffer – maximum stack size – multiple stack arrangement – memory management in task control block - swapping – overlays – Block page management – replacement algorithms – memory locking – working sets – real time garbage collection – contiguous file systems.

UNIT IV : REAL TIME DATABASES **9**

Real time Databases – Basic Definition, Real time Vs General Purpose Databases, Main Memory Databases, Transaction priorities, Transaction Aborts, Concurrency control issues, Disk Scheduling Algorithms, Two– phase Approach to improve Predictability – Maintaining Serialization Consistency – Databases for Hard Real Time Systems.

UNIT V : EVALUATION TECHNIQUES AND CLOCK SYNCHRONIZATION **9**

Reliability Evaluation Techniques – Obtaining parameter values, Reliability models for Hardware Redundancy–Software error models. Clock Synchronization–Clock, A Nonfault–Tolerant Synchronization Algorithm – Impact of faults – Fault Tolerant Synchronization in Hardware – Fault Tolerant Synchronization in software.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Apply principles of real time system design techniques to develop real time applications.
- Examined the Requirements for Software Engineering Process.
- Make use of database in real time applications.
- Make use of architectures and behaviour of real time operating systems.
- Apply evaluation techniques and Clock Synchronization in application.

TEXT BOOKS

1. C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, 1997.
2. Philip.A.Laplante, "Real Time System Design and Analysis", Prentice Hall of India,3rd Edition, 2004.

REFERENCES

1. Rajib Mall, "Real-time systems: theory and practice", Pearson Education, 2009.
2. R.J.A Buhur, D.L Bailey, "An Introduction to Real-Time Systems", Prentice Hall International, 1999.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105229/ (Introduction)
2. https://nptel.ac.in/courses/106/105/106105036/ (Real time databases)

21PCP202 **DATA VISUALIZATION TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- State the basic introduction of Visualization Designs.
- Understand how accurately represent voluminous complex data set in web and from other data sources.
- Understand the methodologies used to visualize large data sets.
- Analyse the process involved in data visualization.
- Understand the security aspects involved in data visualization.

UNIT I : INTRODUCTION **9**

Context of data visualization - Definition, Methodology, Visualization design objectives. Key Factors - Purpose, visualization function and tone, visualization design options – Data representation, Data Presentation, Seven stages of data visualization, widgets, data visualization tools.

UNIT II : VISUALIZING DATA METHODS **9**

Mapping - Time series - Connections and correlations - Scatter plot maps - Trees, Hierarchies and Recursion - Networks and Graphs, Info graphics.

UNIT III : VISUALIZING DATA PROCESS **9**

Acquiring data - Where to Find Data, Tools for Acquiring Data from the Internet, Locating Files for Use with Processing, Loading Text Data, Dealing with Files and Folders, Listing Files in a Folder, Asynchronous Image Downloads, Advanced Web Techniques, Using a Database, Dealing with a Large Number of Files. Parsing data - Levels of Effort, Tools for Gathering Clues, Text Is Best, Text Markup Languages, Regular Expressions (regexps), Grammars and BNF Notation, Compressed Data, Vectors and Geometry, Binary Data Formats, Advanced Detective Work.

UNIT IV : INTERACTIVE DATA VISUALIZATION **9**

Drawing with data –Scales - Axes –Updates, Transition and Motion - Interactivity - Layouts – Geo mapping – Exporting, Framework - D3.js, tableau, Google chart-Jupyter.

UNIT V : SECURITY DATA VISUALIZATION **9**

Port scan visualization -Vulnerability assessment and exploitation -Firewall log visualization - Intrusion detection log visualization - Attacking and defending visualization systems - Creating security visualization system.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Understand the basics about virtualization designs.
- Design and use various methodologies present in data visualization.
- Discuss the process involved and security issues present in data visualization.
- Apply appropriate visualization techniques.
- Create a secure visualization system.

TEXT BOOKS

1. Scott Murray, "Interactive data visualization for the web", O"Reilly Media, Inc., 2013.
2. Ben Fry, "Visualizing Data", O"Reilly Media, Inc., 2007.

REFERENCES

1. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", No Starch Press Inc, 2007.
2. Claus Wilke, "Fundamentals of Data Visualization",O`Reilly Publishers.

E-RESOURCES

1. https://nptel.ac.in/courses/110/107/110107092/ (Data Visualization)
2. https://nptel.ac.in/courses/106/106/106106179/ (Visualizing Data Methods)

21PCP203 INTEGRATED SOFTWARE PROJECT MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Explain the software process framework.
- Discuss managed and optimized software process.
- Evaluate and select the projects against strategic, technical and economic criteria.
- Generate the activity plan and to estimate the overall duration of a project and to minimize the risks.
- Monitor and control the cost, changes in the project and to manage the project contracts effectively.

UNIT I : PROCESS DEFINITION 9

Software Maturity Framework – Software Standards: Benefits, Establishment of standards, Examples – Inspections – Defining the Software Process - Software Engineering Process Group.

UNIT II : PROCESS MANAGEMENT AND OPTIMIZATION 9

Data Gathering and Analysis – Managing Software Quality - Defect Prevention – Automating the Software Process – Contracting for software: Negotiation, Software Contract Principles, Managing software contract, Process Certification .

UNIT III : PROJECT MANAGEMENT AND EVALUATION 9

Project Management Overview – Activities Covered By Software Project Management - Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT IV : ACTIVITY PLANNING 9

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT V : MONITORING AND CONTROL 9

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control – Managing

Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Elaborate the software process framework.
- Able to manage and optimize the software process.
- Apply cost benefit evaluation techniques for project plan.
- Create an activity plan and formulate the network model for each and every software Projects.
- Solve the various risks and hazards problems using risk planning and control techniques.

TEXT BOOKS

1. Watts S. Humphrey, "Managing the Software Process", Pearson Education, 2008.
2. Bob Hughes, Mikecotterell, "Software Project Management", 5th Edition, Tata McGraw Hill, 2011.

REFERENCES

1. Robert K.Wysocki, "Effective Project Management: Traditional, Agile, Extreme", 6th Edition, Wiley, 2011
2. Watts S. Humphrey, "Introduction to the Team Software Process", Pearson Education, 2006

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105218/ (Software Project Management)
2. https://nptel.ac.in/courses/110/104/110104073/ (Software Process)

21PCP204 MODERN COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Introduce the students to the recent trends in the field of Computer Architecture.
- Identify the performance related parameters.
- Learn the different multiprocessor issues.
- Expose the different types of multicore architectures.
- Understand the design of the memory hierarchy.

UNIT I : FUNDAMENTALS OF COMPUTER DESIGN AND ILP 9

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction - Dynamic Scheduling - Hardware-Based Speculation - Exploiting ILP - Instruction Delivery and Speculation - Limitations of ILP – Multithreading.

UNIT II : MEMORY HIERARCHY DESIGN 9

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT III : MULTIPROCESSOR ISSUES 9

Introduction- Centralized, Symmetric and Distributed Shared Memory Architectures –Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study-Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.

UNIT IV : MULTICORE ARCHITECTURES 9

Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse-scale computersArchitectures- Physical Infrastructure and Costs- Cloud Computing –Case Study-Google Warehouse-Scale Computer.

UNIT V : VECTOR, SIMD AND GPU ARCHITECTURES 9

Introduction-Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism-Case Studies.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify the limitations of ILP.
- Discuss the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multicore architectures and how they exploit parallelism.
- Discuss the various techniques used for optimising the cache performance.
- Design hierarchal memory system and point out how data level parallelism is exploited in architectures.

TEXT BOOKS

1. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson Education, 2011.
2. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", Morgan Kauffman, 2010.

REFERENCES

1. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Morgan Kaufmann / Elsevier, 5th Edition, 2012.
2. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw Hill, NewDelhi, 2003

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105163/ (Multicore Architecture)
2. https://nptel.ac.in/courses/106/102/106102157/ (Parallelism)

21PCP205 SOFTWARE ARCHITECTURES AND DESIGN L T P C
3 0 0 3

OBJECTIVES

The main objective of the course is to:

- Understand the architectural requirements.
- Learn the architectural structures.
- Understand the architectural documentation.
- Analyze the architectural alternatives.
- Learn the mapping of architecture against the drivers.

UNIT I : ARCHITECTURAL DRIVERS 9

Introduction – Standard Definitions of Software Architecture– Architectural structures – Influence of software architecture on organization – Architecture Business Cycle – Functional requirements – Technical constraints – Quality Attributes – Quality Attribute Workshop (QAW) – Documenting Quality Attributes – Six part scenarios.

UNIT II : ARCHITECTURAL VIEWS AND DOCUMENTATION 9

Introduction – Standard Definitions for views – Structures and views- Perspectives: Static, dynamic and physical and the accompanying views – Representing views-available notations – Good practices in documentation– Documenting the Views using UML – Merits and Demerits of using visual languages – Need for formal languages - Architectural Description Languages – ACME.

UNIT III : ARCHITECTURAL STYLES 9

Introduction – Data flow styles – Call-return styles – Shared Information styles – Event styles – Case studies for each style.

UNIT IV : ARCHITECTURAL DESIGN 9

Approaches for architectural design – System decomposition – Attributes driven design – Architecting for specific quality attributes – Performance, Availability – Security – Architectural conformance.

UNIT V : ARCHITECTURE EVALUATION AND SOME SPECIAL TOPICS 9

Need for evaluation – Scenario based evaluation against the drivers – ATAM and its variations – Case studies in architectural evaluations – Adaptive structures - Introduction to Architectural patterns.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Capable of understanding the architectural requirements.
- Ability to identify the structure of architecture.
- Develop a proper documentation regarding architecture .
- Pick out right architectural style for the given problem.
- Ability to generate multiple architectures for given problem.

TEXT BOOKS

1. Len Bass, Paul Clements, and Rick Kazman, "Software Architectures Principles and Practices", 3rd Edition, SEI Series in Software Engineering, 2013.
2. Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers, Reed Little, Paulo Merson, Robert Nord, and Judith Stafford, "Documenting Software Architectures. Views and Beyond", 2nd Edition, SEI Series in Software Engineering, 2010.

REFERENCES

1. Anthony J Lattanze, "Architecting Software Intensive System. A Practitioner's Guide", Auerbach Publications, 2010.
2. Frank Bachmann, Regine Meunier, Hans Rohnert "Pattern OrientedSoftware Architecture" Volume1, 2008 reprint.

E-RESOURCES

1. https://nptel.ac.in/courses/106/101/106101061/ (Software Architecture)
2. https://nptel.ac.in/courses/106/105/106105087/ (Architectural Styles)

SEMESTER II

PROFESSIONAL ELECTIVE III

21PCP206 HUMAN COMPUTER INTERACTION L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- LearnthefoundationsofHumanComputerInteraction.
- Understand the role of software process.
- Befamiliar with thedesigntechnologiesforindividualsandpersonswithdisabilities.
- Be awareofmobile HCI.
- Learntheguidelines foruserinterface.

UNIT I : FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The computer:Devices –Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles –elements—interactivity-Paradigms.

UNIT II : DESIGN & SOFTWARE PROCESS 9

Interactive Design basics — process — scenarios — navigation — screen design — Iteration andprototyping. HCI in software process – software life cycle – usability engineering – Prototyping inpractice – design rationale. Design rules – principles, standards, guidelines, rules. EvaluationTechniques—UniversalDesign.

UNIT III : MODELS AND THEORIES 9

Cognitive models –Socio-Organizational issues and stake holder requirements – Communication andcollaborationmodels-Hypertext,MultimediaandWWW.

UNIT IV : MOBILE HCI 9

MobileEcosystem:Platforms,Applicationframeworks-
TypesofMobileApplications:Widgets,Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of MobileDesign,Tools.

UNIT V : WEB INTERFACE DESIGN 9

Designing Web Interfaces — Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and VirtualPages,ProcessFlow.CaseStudies.

TOTAL:45PERIODS

OUTCOMES

After completing this course, students should be able to:

- Designeffectivedialogfor HCI.
- DesigneffectiveHCIfor individualsandpersonswithdisabilities.
- Assesstheimportance ofuser feedback.
- Explainthe HCIimplicationsfordesigningmultimedia/ecommerce/e-learningWebsites.
- Develop meaningful user interface.

TEXT BOOKS

1. AlanDix,JanetFinlay,GregoryAbowd,RussellBeale,"HumanComputerInteraction",3rdEditio n,PearsonEducation,2004(UNITI,II& III).
2. BrianFling,"MobileDesignandDevelopment",1stEdition,O"ReillyMediaInc.,2009(UNIT–IV).

REFERENCES

1. Yvonne Rogers, Helen Sharp, Jenny Preece, Interaction Design: beyond human-computer interaction, John- Wiley and Sons Inc., 2011.
2. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, "Human Computer Interaction", Pearson Education, 2008.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106177/ (Human Computer Interaction)
2. https://nptel.ac.in/courses/106/103/106103115/ (Introduction to Computer Interaction)

21PCP207 **BLOCKCHAIN TECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn the foundations of crypto currency and block chain Technologies.
- Understand the role of crypto currency.
- Know the concept of Bit coin.
- Study the siginificance of Ethereum.
- Learn the guidelines for hyper ledger.

UNIT I : CRYPTO CURRENCY AND BLOCKCHAIN- INTRODUCTION **9**

Blockchain- An Introduction, Distinction between databases and blockchain, Distributed ledger. Blockchain ecosystem - Consensus Algorithms & Types, Blockchain structure, Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain Digital Disruption in Industries – Banking, Insurance, Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains.

UNIT II : CRYPTO CURRENCIES **9**

Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies - Digital Signatures - Cryptocurrency Hash Codes -Need for Crypto Currencies – Crypto Markets – Explore Crypto Currency Ecosystems - ICOs – Crypto Tokens - Atomic Swaps – Crypto Currency Exchanges – Centralised and Decentralized Crypto exchanges – Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks.

UNIT III : BITCOIN **9**

Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions- Parameters that invalidate the transactions- Scripting language in Bitcoin- Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

UNIT IV : ETHEREUM **9**

The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum- different stages of a contract deployment- Viewing Information about blocks in Block chain- Developing smart contract on private Block chain- Deploying contract from web and console.

UNIT V : HYPER LEDGER **9**

Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers- Application programming interface- Application model -Hyperledger frameworks- Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Discover the secure and efficient transactions with crypto-currencies.
- Experiment with crypto currency trading and crypto exchanges.
- Develop private block chain environment and develop a smart contract on Ethereum.
- Understanding the role of Ethereum.
- Build the hyper ledger architecture and the consensus mechanism applied in the hyper ledger.

TEXT BOOKS

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", 2nd Edition, Packt Publishing, 2018.
2. Kumar Saurabh,Ashutosh Saxena, "Blockchain Technology: Concepts and Applications", Wiley Technology Emerging series, September 2020.

REFERENCES

1. Andreas M Antonopoulos,"Mastering Bitcoin: Unlocking Digital Cryptocurrencies", 2018.
2. Henning Diedrich, "Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations",2016.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105184/ (Introduction to BlockChain)
2. https://nptel.ac.in/courses/106/104/106104220/ (BlockChain Technology)

21PCP208 **COMPUTER VISION** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Review image processing techniques for computer vision.
- Analyze Hough Transform and its applications to detect lines, circles, ellipses.
- Examine three-dimensional image analysis techniques.
- State the motion analysis.
- Analyze some applications of computer vision algorithms.

UNIT I : IMAGE PROCESSING FOUNDATIONS **9**

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II : SHAPES AND REGIONS **9**

Binary shape analysis – connectedness – object labeling and counting – size filtering – distancefunctions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors — moments.

UNIT III : HOUGH TRANSFORM **9**

Line detection — Hough Transform (HT) for line detection — foot-of-normal method — line localization – line fitting – RANSAC for straight line detection – HT based circular object detection– accurate center location – speed problem – ellipse detection – Case study: Human Iris location– hole detection – generalized Hough Transform (GHT) – spatial matched filtering – GHT forellipse detection – object location – GHT for feature collation.

UNIT IV : 3D VISION AND MOTION **9**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametricmotion – spline-based motion – optical flow – layered motion.

UNIT V : APPLICATIONS **9**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Implement fundamental image processing techniques required for computer vision and apply chain codes and other region descriptors
- Apply Hough Transform for line, circle, and ellipse detections.
- Apply 3D vision techniques.
- Implement motion related techniques.
- Develop applications using computer vision techniques.

TEXT BOOKS

1. D. L. Baggio et al., "Mastering OpenCV with Practical Computer Vision Projects", Packt Publishing, 2012.
2. E. R. Davies,"Computer & Machine Vision", 4th Edition, Academic Press, 2012.

REFERENCES

1. Mark Nixon and Alberto S. Aquado, "Feature Extraction & Image Processing for ComputerVision", 3rd Edition, Academic Press, 2012.
2. R. Szeliski, "Computer Vision: Algorithms and Applications", Springer 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106224/ (Deep Learning for Computer Vision)
2. https://nptel.ac.in/courses/106/105/106105216/ (Fundamentals of Image Processing)

21PCP209 CYBER SECURITY AND COMPUTER FORENSICS L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the threats in networks and security concepts.
- Apply authentication applications in different networks.
- Understand security services for email.
- Identify the essential and up-to-date concepts, algorithms, protocols, tools.
- Study the methodology of Computer Forensics.

UNIT I : INTRODUCTION TO CYBER SECURITY 9

Ethical hacking, Attack Vectors, Cyberspace and Criminal Behaviour, Clarification of Terms, Traditional Problems associated with Computer Crimes, Realms of Cyber world, brief history of the internet, contaminants and destruction of data, unauthorized access, computer intrusions, white-collar crimes, viruses and malicious code, virus attacks, pornography, software piracy, mail bombs, exploitation, stalking and obscenity in internet, Cyber psychology, Social Engineering.

UNIT II : DIGITAL FORENSICS 9

Introduction to Digital forensics, Forensic software and handling, forensic hardware and handling, analysis and advanced tools, forensic technology and practices, Biometrics: face, iris and fingerprint recognition, Audio-video evidence collection, Preservation and Forensic Analysis.

UNIT III : SECURITY SERVICES 9

Investigation Tools, e-discovery, EDRM Models, digital evidence collection and preservation, email investigation, email tracking, IP tracking, email recovery, search and seizure of computer systems, password cracking.

UNIT IV : COMPUTER FORENSICS 9

Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications.

UNIT V : PROCESSING OF DIGITAL EVIDENCE 9

Processing of digital evidence, digital images damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, and compressed files.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Usages of cyber security and its applications.
- Analyze and Integrate various Digital Forensics.
- Analyze various investigation tools.
- Know the process of digital evidence effectively and efficiently.
- Understand the Methodology of Cyber Forensics.

TEXT BOOKS

1. Charles P. Fleeger, "Security in Computing", 5th Edition, Prentice Hall, New Delhi, 2015.
2. BehrouzA.Forouzan, "Cryptography & Network Security", 3rd Edition, Tata McGraw Hill, India, New Delhi, 2015.

REFERENCES

1. William Stallings, "Cryptography and Network Security", Prentice Hall, New Delhi, 2006.
2. C. Altheide& H. Carvey, "Digital Forensics with Open Source Tools", Syngress, 2011.

E-RESOURCES

1. https://onlinecourses.swayam2.ac.in/nou21_cs08/preview (Introduction to Cyber Security)
2. https://www.coursera.org/specializations/coputerforensics (Computer Forensics)

21PCP210 SOFTWARE QUALITY ASSURANCE AND TESTING **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the basics of testing, test planning &design and test team organization.
- Study the various types of test in the life cycle of the software product.
- Build design concepts for system testing and execution.
- Learn the software quality assurance ,metrics, defect prevention techniques.
- Learn the techniques for quality assurance and applying for applications**.**

UNIT I : SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES **9**

Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management**-**Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building.

UNITII : SYSTEMTESTING **9**

System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Built- in Testing. Functional testing - Testing a Function in Context. Boundary Value Analysis.

UNITIII : SYSTEM TESTCATEGORIES **9**

System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests.

UNIT IV : SOFTWARE QUALITY **9**

Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement ,Testing Maturity Model.

UNIT V : SOFTWARE QUALITY ASSURANCE **9**

Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Perform functional and nonfunctional tests in the life cycle of the software product.
- Understanding the role of system Testing.
- Understand system testing and test execution process.
- Identify defect prevention techniques and software quality assurance metrics.
- Apply techniques of quality assurance for typical applications.

TEXT BOOKS

1. William E. Perry, "Effective Methods for Software Testing", 3rd Edition, Wiley India, 2009
2. Naresh Chauhan, "Software Testing – Principles and Practices", Oxford University Press, 2010.

REFERENCES

1. KshirasagarNakPriyadarshiTripathy, "SoftwareTestingAndQualityAssurance-TheoryandPractice",JohnWiley &SonsInc,2008
2. JeffTian,"SoftwareQuality Engineering: Testing, Quality Assurance, and QuantifiableImprovement",JohnWiley&Sons,Inc.,Hoboken,NewJersey.2005.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105150/ (Introduction to Software Testing)
2. https://nptel.ac.in/courses/106/101/106101163/ (Motivation Software Testing)

SEMESTER III

PROFESSIONAL ELECTIVE - IV

21PCP301	**SECURITY FOR IoT**	**L T P C** **3 1 0 4**

OBJECTIVES

The main objective of this course is to:

- Acquire knowledge about Internet of Things.
- Learn about the basics of IOT protocols.
- Build a small low cost embedded system using Raspberry Pi.
- Apply the concept of Internet of Things in the real world scenario.
- Understand the Problem of IOT Attack.

UNIT I : IoT SECURITY OVERVIEW **9+3**

IoT Reference Model- Introduction -Functional View,IoT Security Challenges-Hardware Security Risks - Hardcoded/Default Passwords -Resource Constrained Computations -Legacy Assets Connections - Devices Physical Security, Software Security Risks -Software Vulnerabilities - Data Interception - Identification of Endpoints -Tamper Detection, Lack of Industrial Standards.

UNIT II : IoT SECURITY &VULNERABILITY ISSUES **9+3**

IoT Security Requirements -Data Confidentiality -Data Encryption -Data Authentication - Secured Access Control –IoT-Vulnerabilities – Secret-Key, Authentication/Authorization for Smart Devices - Constrained System Resources -Device Heterogeneity -Fixed Firmware.IoT Attacks -Side-channel Attacks.

UNIT III : SECURED PROTOCOLS FOR IoT **9+3**

Infrastructure-IPv6 -LowPAN , Identification-Electronic Product Code -uCode, Transport-Bluetooth - LPWAN, Data -MQTT -CoAP, Multi-layer Frameworks-Alljoyn,-IoTivity.

UNIT IV : SECURING INTERNET OF THINGS ENVIRONMENT **9+3**

IoT Hardware -Test Device Range-Latency and Capacity -Manufacturability Test -Secure from Physical Attacks, IoT Software -Trusted IoT Application Platforms, -Secure Firmware Updating - Network Enforced Policy -Secure Analytics Visibility and Control.

UNIT V : IOT ATTACKS -CASE STUDY **9+3**

MIRAI Botnet Attack -Iran's Nuclear FacilityStuxnet Attack -TeslaCryptojacking Attack -The TRENDnetWebcam Attack -The JeepSUV Attack -The Owlet Wi-Fi Baby Heart Monitor Vulnerabilities.

TOTAL: 45+15 =60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Acquire knowledge about IoT general models and security challenges.
- Recognize IoT security and vulnerability threats.
- Understand different IoT protocols and their security measures.
- Interpret how to secure an IoT environment.
- Interpret different IoT types of attacks.

TEXT BOOKS

1. Fei HU, "Security and Privacy in Internet of Things (IoTs): Models Algorithms and Implementations", CRC Press,2016.
2. Russell, Brian Drew, Van Duren, "Practical Internet of Things Security", Packt Publishing, 2016.

REFERENCES

1. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014.
2. Arsheep Bahga , Vijay Madisetti "Internet Of Things: A Hands-On Approach ", 1st Edition, Pearson Education, 16 August 2017.

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview(Introduction to IoT).
2. https://onlinecourses.nptel.ac.in/noc21_ee85/preview(Design for IoT).

21PCP302 PARALLEL PROGRAMMING PARADIGMS L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the fundamentals of parallel programming.
- Familiarize the issues in parallel computing.
- Describe distributed memory programming using MPI.
- Understand shared memory paradigm with Pthreads and OpenMP.
- Learn the GPU based parallel programming using OpenCL.

UNIT I : FOUNDATIONS OF PARALLEL PROGRAMMING 9+3

Motivation for parallel programming – Need-Concurrency in computing – Basics of processes, multitasking and threads–Issues in shared memory model and distributed memory model – Parallel Software- Caveats- coordinating processes/ threads- hybrid model – shared memory model and distributed memory model - I/O – performance of parallel programs-– parallel program design.

UNIT II : DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9+3

Basic MPI programming – MPI_Init and MPI_Finalize – MPI communicators – SPMD-programs– MPI_Send and MPI_Recv – message matching – MPI- I/O – parallel I/O – collective communication – Tree-structured communication -MPI_Reduce – MPI_Allreduce.

UNIT III : SHARED MEMORY PARADIGM WITH PTHREADS 9+3

Basics of threads, Pthreads – thread synchronization – critical sections – busy waiting – mutex – semaphores – barriers and condition variables – read write locks with examples - Thread safety-Pthreads case study.

UNIT IV : SHARED MEMORY PARADIGM: OPENMP 9+3

Basics OpenMP – Trapezoidal Rule-scope of variables – reduction clause – parallel for directive – loops in OpenMP – scheduling loops –Producer Consumer problem – cache issues – threads safety in OpenMP.

UNIT V : GRAPHICALPROCESSING PARADIGMS 9+3

Introduction to OpenCL - Example-OpenCL Platforms - Devices-Contexts - OpenCL programming – Event model – Command-Queue - Event Object - case study. Introduction to CUDA programming.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Understand the knowledge about the parallel processing.
- Identify issues in parallel programming.
- Develop distributed memory programs using MPI framework.
- Design and develop shared memory parallel programs using Pthreads and usingopenMP.
- Implement Graphical Processing OpenCL programs.

TEXT BOOKS

1. A.Munshi, B.Gaster,T.G.Mattson, J. Fung, and D. Ginsburg, "OpenCL programming guide", Addison Wesley, 2011.
2. Peter S. Pacheco," An introduction to parallel programming", Morgan Kaufmann, 2011.

REFERENCES

1. Rob Farber," CUDA application design and development", Morgan Haufmann, 2011.
2. W. Gropp, E.Lusk, and A.Skjellum,"Using MPI:Portable parallel programming with the message passing interface", 2nd Edition, MIT Press, 1999.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc19_cs45/preview - (Introduction to Parallel Programming in Open MP).
2. https://nptel.ac.in/courses/106/102/106102114/(Introduction Shared Memory Paradigm).

21PCP303 **DESIGN THINKING** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the concepts of design thinking approaches.
- Create design thinking teams and conduct design thinking sessions.
- Apply both critical thinking and design thinking in parallel to solve problems.
- Provide an authentic opportunity for students to develop teamwork and leadership skills.
- Apply some design thinking concepts to their daily work.

UNIT I : PROCESS OF DESIGN **9+3**

Introduction – Product Life Cycle - Design Ethics - Design Process - Four Step - Five Step - Twelve Step - Creativity and Innovation in Design Process - Design limitation.

UNIT II : GENERATING AND DEVELOPING IDEAS **9+3**

Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Anologies – Brainstorming - Mind mapping - National Group Technique – Synectics - Development of work - Analytical Thinking - Group Activities Recommended.

UNIT III : REVERSE ENGINEERING **9+3**

Introduction - Reverse Engineering Leads to New Understanding about Products - Reasons for Reverse Engineering - Reverse Engineering Process - Step by Step - Case Study.

UNIT IV : BASICS OF DRAWING TO DEVELOP DESIGN IDEAS **9+3**

Introduction - Many Uses of Drawing - Communication through Drawing - Drawing Basis – Line - Shape/ Form – Value – Colour – Texture - Practice using Auto CAD recommended.

UNIT V : TECHNICAL DRAWING TO DEVELOP DESIGN **9+3**

Introduction - Perspective Drawing - One Point Perspective - Two Point Perspective - Isometric Drawing - Orthographic Drawing - Sectional Views - Practice using Auto CAD recommended.

.

TOTAL: 45+15 = PERIODS

OUTCOMES

After completing this course, students should be able to:

- Appreciate various design process procedure.
- Generate and develop design ideas through different technique.
- Identify the significance of reverse Engineering to Understand products.
- Understanding the basics idea of drawing to development.
- Draw Basics of Drawing and technical drawing for design ideas.

TEXT BOOKS

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage learning (International Edition) 2nd Edition, 2013.
2. Vijay Kumar "A Structured Approach for Driving Innovation in Your Organization" John wiley and sons Inc,2012.

REFERENCES

1. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning, 2nd Edition, 2011.
2. IDEO, "The Field Guide to Human-Centered Design" IDEO 1st Edition, 2015 .

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_mg38/preview (Introduction to Design Thinking).
2. http://www.digimat.in/nptel/courses/video/110106124/L02.html. (Basic Technical drawing to develop Design)

21PCP304 PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the mathematical foundations needed for performance evaluation of computer systems.
- Understand the metrics used for performance evaluation.
- Understand the analytical modelling of computer systems.
- Enable the students to develop new queuing analysis for both simple and complex systems.
- Appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies.

UNIT I : OVERVIEW OF PERFORMANCE EVALUATION 9+3

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little's Law and other Operational. Laws-Modification for closed systems.

UNIT II : MARKOV CHAINS AND SIMPLE QUEUES 9+3

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1.

UNIT III : MULTI-SERVER AND MULTI-QUEUE SYSTEMS 9+3

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke's Theorem – Networks of Queues and Jackson Product Form – Classed and closed networks of queues.

UNIT IV : REAL-WORLD WORKLOADS 9+3

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Analytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.

UNIT V : SMART SCHEDULING IN THE M/G/1 9+3

Performance Metrics – Scheduling Non-Pre-emptive and Pre-emptive Non-Size-Based Policies - Scheduling Non-Pre-emptive and Pre-emptive Size-Based Policies – Scheduling - SRPT and Fairness.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify the need for performance evaluation and the metrics used for it.
- Distinguish between open and closed queuing networks.
- Apply the operational laws to open and closed systems.
- Use discrete-time and continuous-time Markov chains to model real world systems.
- Develop analytical techniques for evaluating scheduling policies.

TEXT BOOKS

1. K.S.Trivedi "Probability and Statistics with Reliability, Queueing and Computer Science Applications", John Wiley and Sons, 2001.
2. Lieven Eeckhout, Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers, 2010.

REFERENCES

1. MorHarchol - Balter, "Performance Modeling and Design of ComputerSystems Queueing Theory in Action", Cambridge University Press,2013.
2. PaulJ.Fortier and Howard E.Michel, "Computer Systems Evaluations and Prediction", Elsevier, 2003.

E-RESOURCES

1. http://www.nptelvideos.in/2012/11/performance-evaluation-of-computer.html (Introduction to Performance evaluation).
2. https://www.coursera.org/learn/algorithms-part1.(Introduction to Real world Worloads)

21PCP305 COMPILER OPTIMIZATION TECHNIQUES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Be aware of different forms of intermediate languages and analyzing programs.
- Understand the loop optimization techniques.
- Understand optimizations techniques for simple program blocks.
- Apply optimizations on procedures control flow and parallelism.
- Learn the inter procedural analysis and optimizations and to explore the knowledge about resource utilization.

UNIT : I INTERMEDIATE REPRESENTATIONS AND ANALYSIS 9+3

Review of Compiler Structure-Structure of an Optimizing Compiler–Intermediate Languages - LIR, MIR, HIR – Control Flow Analysis – Iterative Data Flow Analysis – Static Single-Assignment – Dependence Relations -Dependences in Loops and Testing-Basic Block Dependence DAGs – Alias Analysis.

UNIT : II EARLY AND LOOP OPTIMIZATIONS 9+3

Importance of Code Optimization Early Optimizations: Constant-ExpressionEvaluation-ScalarReplacementofAggregates-Algebraic Simplification and Re-association,Value Numbering - Copy Propagation – Sparse Conditional Constant Propagation, Loop Optimizations.

UNIT III : PROCEDURE OPTIMIZATION AND SCHEDULING 9+3

Procedure Optimizations: Tail-Call Optimization and Tail-Recursion Elimination-Procedure Integration-In-Line Expansion-Leaf-Routine Optimization and Shrink Wrapping Code Scheduling, Instruction Scheduling.

UNIT IV : INTERPROCEDURAL OPTIMIZATION 9+3

Symbol table–Runtime Support-Inter procedural Analysis and Optimization: Inter procedural Control Flow Analysis - The Call Graph – Inter procedural Data-Flow Analysis-Inter procedural Constant Propagation- Inter procedural Alias Analysis - Inter procedural Optimizations .

UNIT V : REGISTER ALLOCATION AND OPTIMIZING FOR MEMORY 9+3

Register Allocations: Register Allocation and Assignment - Local Methods -GraphColoring–Priority Based GraphColoring-OtherApproaches to Register Allocation. Optimization for the Memory Hierarchy.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify the different forms of intermediate languages and analyzing programs.
- Identify the different optimization techniques for simple program blocks.
- Design performance enhancing optimization techniques.
- Perform the optimization on procedures.
- Ensure better utilization of resources.

TEXT BOOKS

1. Alfred V.Aho, Ravi Sethi, Jeffrey D.Ullman,"Compilers Principles Techniques and Tools", Addison Wesley, 2nd Edition, 2007.
2. Andrew W.Appel, Jens Palsberg,"Modern Compiler Implementation in Java", Cambridge University Press, 2nd Edition, 2002.

REFERENCES

1. Keith Cooper, Linda Torczon,"Engineering a Compiler", Morgan Kaufmann, 2nd Edition, 2011.
2. Robert Morgan,"Building an Optimizing Compiler",Digital Press,1998.

E - RESOURCES

1. https://www.embedded.com/advanced-compiler-optimization-techniques/.(Introduction to Compiler Optimization Techniques).
2. https://www.tutorialspoint.com/compiler_design/.(Introduction to Compiler Design).

SEMESTER III

PROFESSIONAL ELECTIVE - V

21PCP306	**COGNITIVE COMPUTING**	**L T P C** **3 1 0 4**

OBJECTIVES

The main objective of this course is to:

- To learn about design of cognitive systems.
- To be familiar with techniques to support cognitive systems.
- Able to analyze the effectiveness of a cognitive system.
- Understand the deployment of cognitive applications.
- Understand the development process of cognitive systems.

UNIT I : INTRODUCTION TO COGNITIVE COMPUTING **9+3**

The Foundation of Cognitive Computing-Cognitive Computing as a New Generation-The Uses of Cognitive Systems-What Makes a System Cognitive?-Artificial Intelligence as the Foundation of Cognitive Computing-Understanding Cognition-Understanding Complex Relationships Between Systems-The Elements of a Cognitive System-Design Principles for Cognitive Systems-Components of a Cognitive System.

UNIT II : NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS **9+3**

Natural Language Processing in Support of a Cognitive System-The Role of NLP in a Cognitive System-Semantic Web-Applying Natural Language Technologies to Business Problems. Representing Knowledge in Taxonomies and Ontologies-Representing Knowledge Defining Taxonomies and Ontologies.

UNIT III : ADVANCED ANALYTICS IN COGNITIVE COMPUTING **9+3**

Applying Advanced Analytics to Cognitive Computing-Advanced Analytics Is on a Path to Cognitive Computing-Key Capabilities in Advanced Analytics-Using Advanced Analytics to Create Value-Impact of Open Source Tools on Advanced Analytics- Case studies.

UNIT IV : COGNITIVE SYSTEMS APPROACHES **9+3**

The Role of Cloud and Distributed Computing in Cognitive Computing-Leveraging Distributed Computing for Shared Resources-Why Cloud Services Are Fundamental to Cognitive Computing Systems.

UNIT V : BUILDING A COGNITIVE APPLICATION **9+3**

The Process of Building a Cognitive Application-The Emerging Cognitive Platform-Defining the Objective-Defining the Domain-Understanding the Intended Users and Defining their Attributes-Defining Questions and Exploring Insights-Creating and Refining the Corpora Training and Testing.

TOTAL:45+15=60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Clear understanding of the elements and principles in designing a cognitive system.
- Appreciate the role of Natural language processing and knowledge representation in Cognitive systems.
- Analyze a cognitive computing system through case studies.
- Able to select an appropriate approach to build a cognitive system.
- Provide a system flow to deploy a cognitive application.

TEXT BOOKS

1. Marcia Kaufman Adrian Bowles, Judith Hurwitz,"Cognitive Computing and Big Data Analytics", 1st Edition, Wiley,2015.

2. Peter Fingar, "Cognitive Computing" Meghan-Kiffer Press,2016.

REFERENCES

1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python Analyzing text with natural language toolkit", O'Reilly Media , 2009.
2. Tom M. Mitchell, "Machine Learning" , McGraw Hill,2015.

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs51/preview (Introduction to cognitive computing)
2. https://www.ibm.com/developerworks/learn/cognitive/(Developing cognitive applications).

21PCP307 **SECURITY PRACTICES** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Learn the core fundamentals of system and web security concepts.
- Understanding the security concepts related to the networks.
- Deploy the security essentials in IT Sector.
- Be exposed to the concepts of Cyber Security and encryption Concepts.
- Perform a detailed study of Privacy and Storage security and related Issues.

UNIT I : SYSTEM SECURITY **9+3**

Building a secure organization- A Cryptography primer- detecting system Intrusion- Preventing system Intrusion- Fault tolerance and Resilience in cloud computing environments-Security web applications, services and servers.

UNIT II : NETWORK SECURITY **9+3**

Internet Security - Botnet Problem- Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security- Optical Network Security- Optical wireless Security.

UNIT III : SECURITY MANEGEMENT **9+3**

Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System - Intrusion and Detection and Prevention System.

UNIT IV : CYBER SECURITY AND CRYPTOGRAPHY **9+3**

Cyber Forensics- Cyber Forensics and Incidence Response - Security e-Discovery - Network Forensics - Data Encryption- Satellite Encryption - Password based authenticated Key establishment Protocols.

UNIT V : PRIVACY AND STORAGE SECURITY **9+3**

Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

. **TOTAL: 45+15=60 PERIODS**

OUTCOMES

After completing this course, students should be able to:

- Understand the core fundamentals of system security.
- Apply the security concepts related to networks in wired and wireless scenario.
- Implement and Manage the security essentials in IT Sector.
- Able to explain the concepts of Cyber Security and encryption Concepts.
- Able to attain a thorough knowledge in the area of Privacy and Storage security.

TEXT BOOKS

1. John R.Vacca, "Computer and Information Security Handbook", 2nd Edition, Elsevier, 2013.
2. Michael E. Whitman, Herbert J. Mattord,"Principal of Information Security", 4th Edition, Cengage Learning, 2012.

REFERENCES

1. Richard E.Smith, Elementary Information Security, 2nd Edition, Jones and Bartlett Learning, 2016.
2. Robert Fischer "Introduction to Security ",9th Edition, Butterworth Heinemann,2013.

E - RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_cs16/preview (Introduction to Information Security)
2. https://ishareyoublog.files.wordpress.com/2018/04/cp5291-security-practices-unit-2-docx.(Introduction to Security Management and Cyber Security).

21PCP308 NETWORK DESIGN AND TECHNOLOGIES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the principles required for network design.
- Explore various technologies in the wireless domain.
- Study about 3G cellular networks.
- Study about 4G cellular networks.
- Understand the paradigm of Software defined networks.

UNIT I : NETWORK DESIGN 9+3

Connectionless, Connection oriented, Wireless Scenarios –Applications, Quality of Service – End to end level and network level solutions. LAN cabling topologies – Ethernet Switches, Routers, Firewalls and L3 switches – Remote Access Technologies and Devices – Modems and DSLs – SLIP and PPP – Core networks, and distribution networks.

UNIT II : WIRELESS NETWORKS 9+3

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security– IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS – Bluetooth – Protocol Stack – Security – Profiles.

UNIT III : CELLULAR NETWORKS 9+3

GSM – Mobility Management and call control – GPRS – Network Elements – Radio Resource Management – Mobility Management and Session Management – Small Screen Web Browsing over GPRS and EDGE – MMS over GPRS – UMTS – Channel Structure on the Air Interface – UTRAN –Core and Radio Network Mobility Management – UMTS Security.

UNIT IV : 4G NETWORKS 9+3

LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10) - 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Channel Modelling for 4G – Introduction to 5G.

UNIT V : SOFTWARE DEFINED NETWORKS **9+3**

Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers – General Concepts – VLANs – NVGRE – Open Flow – Network Overlays – Types– Virtualization – Data Plane – I/O – Design of SDN Framework.

TOTAL: 45+15=60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify the components required for designing a network.
- Design a network at a high-level using different networking technologies.
- Analyze the various protocols of wireless and cellular networks.
- Discuss the features of 4G and 5G networks.
- Experiment with software defined networks.

TEXT BOOKS

1. Erik Dahl man, Stefan Parkvall, Johan Skold, "4G:LTE/LTE-Advanced for Mobile Broadband", Academic Press,2013.
2. Jonathan Rodriguez, " Fundamentals of 5G Mobile Networks", Wiley, 2015.

REFERENCES

1. Larry Peterson and Bruce Davie,"Computer Networks: Systems Approach",5th Edition, Morgan Kauffman,2011.
2. Martin Sauter, "From GSM to LTE An Introduction to Mobile Networks and Mobile Broadband", Wiley, 2014.

E-RESOURCES

1. http://www.nptelvideos.in/2012/11/computer-networks.html (Introduction to Network Design and Technologies)
2. https://nasrinword.wordpress.com/cp5201-network-design-and-technologies/.(Introduction to 4G and 5G Networks).

21PCP309 EMBEDDED SOFTWARE DEVELOPMENT L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the architecture of embedded processor, microcontroller and peripheral devices.
- Interface memory and peripherals with embedded systems.
- Study the embedded network environment.
- Understand challenges in Real time operating systems.
- Understand challenges in system design Techniques.

UNIT I : EMBEDDED PROCESSORS 9+3

Embedded Computers-Characteristics of Embedded Computing Applications Challenges in Embedded Computing System Design - Embedded System Design Process-Formalism for System Design-Structural Description-Behavioral Description-ARM Processor–Intel ATOM Processor.

UNIT II : EMBEDDED COMPUTING PLATFORM 9+3

CPU Bus Configuration - Memory Devices and Interfacing - Input/output Devices and Interfacing - System Design - Development and Debugging –Emulator – Simulator - JTAG Design Example – Alarm Clock - Analysis and Optimization of Performance-Power and Program Size.

UNIT III : EMBEDDED NETWORK ENVIRONMENT 9+3

Distributed Embedded Architecture-Hardware and Software Architectures-Networks for Embedded Systems - I2C - CAN Bus - SHARC Link Supports –Ethernet –Myrinet–Internet-Network-based Design-Communication Analysis-System Performance Analysis-Hardware Platform Design-Allocation and Scheduling-Design example-Elevator Controller.

UNIT IV : REAL-TIME CHARACTERISTICS 9+3

Clock Driven Approach - Weighted Round Robin Approach - Priority Driven Approach - Dynamic versus Static Systems - Effective Release Times and Deadlines-Optimality of the Earliest Deadline First (EDF) Algorithm-Challenges in Validating Timing Constraints in Priority Driven Systems - Off-Line versus On-Line Scheduling.

UNIT V : SYSTEM DESIG NTECHNIQUES **9+3**

Design Methodologies-Requirement Analysis-Specification-System Analysis and Architecture Design-Quality Assurance-Design examples–Telephone PBX-Inkjet printer-Personal Digital Assistants-Set-Top Boxes.

TOTAL: 45+15=60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Understand different architectures of embedded processor, microcontroller and peripheral devices interface memory and peripherals with embedded systems.
- Work with embedded network environment.
- Understand challenges in Real time operating systems.
- Design and analyze applications on embedded systems.
- Promoting embedded system.

TEXT BOOKS

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things "Wiley Publication, 1st Edition, 2013.
2. Arshdeep Bahga, Vijay Madisetti,"Internet of Things: A Hands on Approach", VPT 1st Edition, 2014.

REFERENCES

1. Frank Vahid and Tony Givargis, "Embedded System Design: A Unified Hardware Software Introduction",John Wiley&Sons, 2011.
2. Jane.W.S.Liu, "Real Time systems", Pearson Education Asia, 2016.

E - RESOURCES

1. https://nptel.ac.in/courses/117/106/117106112/. (Introduction to Embedded Software).
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview. (Introduction to Embedded Computing Platform)

21PCP310 NATURAL LANGUAGE PROCESSING L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Learn the fundamentals of natural language processing.
- Understand the role of word level analysis.
- Understand the use of CFG and PCFG in NLP.
- Understand the role of semantics of sentences and pragmatics.
- Apply the NLP techniques to IR applications.

UNIT I : INTRODUCTION 9+3

Origins and challenges of NLP – Language Modelling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II : WORD LEVEL ANALYSIS 9+3

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Back off – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III : SYNTACTIC ANALYSIS 9+3

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV : SEMANTICS AND PRAGMATICS 9+3

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation.

UNIT V : DISCOURSE ANALYSIS AND LEXICAL RESOURCE 9+3

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centring Algorithm – Co reference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL: 45+15=60 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Tag a given text with basic Language features.
- Design an innovative application using NLP components.
- Implement a rule based system to tackle morphology/syntax of a language.
- Design a tag set to be used for statistical processing for real-time applications.
- Compare and contrast the use of different statistical approaches for different types of NLP applications.

TEXT BOOKS

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing Computational Linguistics and Speech", Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1st Edition, OReilly Media, 2009.

REFERENCES

1. Breck Baldwin,"Language processing with Java and LingPipe Cookbook", Atlantic Publisher, 2015.
2. Richard M Reese, "Natural Language Processing with Java", OReilly Media, 2015.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc19_cs56/preview .(Introduction to Natural Language Processing)
2. https://onlinecourses.nptel.ac.in/noc20_cs87/preview. (Introduction to Syntactic Analysis).

SEMESTER III

PROFESSIONAL ELECTIVE VI

21PCP311 BIO-INSPIRED COMPUTING L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn bio-inspired theorem and algorithms.
- Understand random walk and simulated annealing.
- Learn genetic algorithm and differential evolution.
- Learn swarm optimization and ant colony for feature selection.
- Understand bio-inspired application in image processing.

UNIT I : INTRODUCTION **9**

Introduction to algorithm - Newton's method - optimization algorithm - No-Free-Lunch Theorems Nature- Inspired Mataheuristics -Analysis of Algorithms -Nature Inspires Algorithms -Parameter tuning and parameter control

UNIT II : RANDOM WALK AND ANEALING **9**

Random variables - Isotropic random walks - Levy distribution and flights - Markov chains - step sizes and search efficiency - Modality and intermittent search strategy - importance of randomization- Eagle strategy-Annealing and Boltzmann Distribution - parameters -SA algorithm - Stochastic Tunneling.

UNIT III : GENETIC ALOGORITHMS AND DIFFERENTIAL EVOLUTION **9**

Introduction to genetic algorithms and - role of genetic operators - choice of parameters - GA variants - schema theorem - convergence analysis - introduction to differential evolution - variants - choice of parameters - convergence analysis - implementation.

UNIT IV : SWARM OPTIMIZATION AND FIREFLY ALGORITHM **9**

Swarm intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - varientsAnt colony optimization toward feature selection.

UNIT V : APPLICATION IN IMAGE PROCESSING **9**

Bio-Inspired Computation and its Applications in Image Processing: An Overview – Fine Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model - Mobile Object Tracking Using Cuckoo Search.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Implement and apply bio-inspired algorithms.
- Explain random walk and simulated annealing.
- Implement and apply genetic algorithms.
- Explain swarm intelligence and ant colony for feature selection.
- Apply bio-inspired techniques in image processing.

TEXT BOOKS

1. Eiben,A.E.,Smith,James E, "Introduction to Evolutionary Computing", Springer 2015.
2. Helio J.C. Barbosa, "Ant Colony Optimization - Techniques and Applications", Intech 2013.

REFERENCES

1. Xin-She Yang , Jaao Paulo papa, "Bio-Inspired Computing and Applications in Image Processing", Elsevier, 2016.
2. Yang ,Cui,XIao,Gandomi,Karamanoglu ,"Swarm Intelligence and Bio-Inspired Computing", Elsevier 1st Edition, 2013.

E-RESOURCES

1. https://tutorials.one/bio-inspired-computing-approach-in-artificial-intelligence/ (Computing Approach in AI)
2. https://www.udemy.com/course/ai-academy-4-learn-bio-inspired-optimization-methods-a-z/ (Optimization)

21PCP312 SPEECH PROCESSING AND SYNTHESIS L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the mathematical foundations needed for speech processing.
- Review the speed signal Representation processing Techniques.
- State the basic concepts and algorithms of speech processing and synthesis.
- Familiarize the students with the various speech signal representation, coding and recognition techniques.
- Appreciate the use of speech processing in current technologies.

UNIT I : FUNDAMENTALS OF SPEECH PROCESSING 9

Introduction – Spoken Language Structure – Phonetics and Phonology – Syllables and Words – Syntax and Semantics – Probability, Statistics and Information Theory – Probability Theory – Estimation Theory – Significance Testing – Information Theory.

UNIT II : SPEECH SIGNAL REPRESENTATIONS AND CODING 9

Overview of Digital Signal Processing – Speech Signal Representations – Short time Fourier Analysis – Acoustic Model of Speech Production – Linear Predictive Coding – Cepstral Processing – Formant Frequencies – The Role of Pitch – Speech Coding – LPC Coder.

UNIT III : SPEECH RECOGNITION 9

Hidden Markov Models – Definition – Continuous and Discontinuous HMMs – Practical Issues – Limitations. Acoustic Modeling – Variability in the Speech Signal – Extracting Features – Phonetic Modeling – Adaptive Techniques – Confidence Measures – Other Techniques.

UNIT IV : TEXT ANALYSIS 9

Lexicon — Document Structure Detection — Text Normalization — Linguistic Analysis — Homograph Disambiguation – Morphological Analysis – Letter-to-sound Conversion – Prosody — Generation schematic — Speaking Style — Symbolic Prosody - Duration Assignment – Pitch Generation.

UNIT V : SPEECH SYNTHESIS **9**

Attributes – Formant Speech Synthesis – Concatenative Speech Synthesis – Prosodic Modification of Speech – Source - filter Models for Prosody Modification – Evaluation of TTS Systems.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should be able to:

- Identify the various temporal, spectral and cepstral features required for identifyingspeech units — phoneme, syllable and word.
- Determine and apply Mel-frequency cepstral coefficients for processing all types of signals.
- Justify the use of formant and concatenative approaches to speech synthesis.
- Identify the apt approach of speech synthesis depending on the language to be processed.
- Determine the various encoding techniques for representing speech.

TEXT BOOKS

1. Lawrence Rabiner, Biiing and- Hwang Juang and B.Yegnanarayana, "Fundamentals of Speech Recognition", Pearson Education, 2009
2. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.

REFERENCES

1. Joseph Mariani, "Language and Speech Processing", Wiley, 2009.
2. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Prentice Hall Signal Processing Series, 1993.

E-RESOURCES

1. http://www.digimat.in/nptel/courses/video/117105145/L37.html (Text to Speech synthesis)
2. https://nptel.ac.in/courses/117/105/117105145/ (Introduction to Digital Image Processing)

21PCP313 INFORMATION SECURITY RISK MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the basics of Information Security and Risk Management.
- Demonstrate and analyze the basic regulations for the IT-security risk process;
- Introduce actual approaches for IT-security risk management and provide students with deep knowledge for the state-of-the-art international standards;
- Implement a safeguards (controls) and direct how these items can be apply efficiently with deep knowledge for the up-to-date IT-security techniques;
- Aware of appropriate international risk management.

UNIT I : INTRODUCTION **9**

Introduction to Information Security - Social Engineering – Human behavior and information security- Risk Management -Complexity of Risk Management – Introduction to Information Security Risk Management - Risk Identification -Risk Assessment - Risk Control Strategies - Selecting a Risk Control Strategy.

.**UNIT II : POLICIES, STANDARDS AND DECISION MAKING** **9**

Information Security Governance - Information Security Policy Basics - Information Security Policy Framework - Information Security Procedures and Standards - Policy Development - Decision Making from a Managerial Perspective - User Decision Making.

UNIT III : INFORMATION SECURITY FRAMEWORKS **9**

Security Frameworks - Challenges - The Risk Management Process- Operational Responsibilities - IT and Cybersecurity Processes - Functional Area Operational Objectives - Controls - Capabilities - Cybersecurity and Enterprise IT.

UNIT IV : SECURITY AND USABILITY **9**

Introduction to Security and Usability - Security Culture: Creating a Culture of Information Security - Computer Ethics - Scanning and Analysis Tools, Access Control Devices - Physical Security - Security and Personnel.

UNIT V : CHANGING THE CULTURE **9**

Changing the Approach to Security- Change the Culture, Change the Game - The Corporate Culture - Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students will be able to:

- Analyze and identify the security threats, attacks and device suitable security policies and Standards.
- Ability to plan, assess and device suitable risk control strategies in practice.
- Ability to implement appropriate intrusion detection and prevention systems to ensure information availability.
- Ability to apply various national, international laws and legal frameworks emphasizing responsibility and accountability at all levels in the organization

TEXT BOOKS

1. Leron Zinatullin,"The Psychology of Information Security Resolving conflicts between security compliance and human behavior", IT Governance Ltd , 2016.
2. Douglas Landoll,"Information Security Policies, Procedures, and Standards - A Practitioner's Reference", CRC Press, 2016.

REFERENCES

1. Jack Freund, Jack Jones ,"Measuring and Managing Information Risk: A FAIR Approach", 1st Edition.
2. Faiyaz Ahamad, "Cyber Law and Information Security", Wiley dreamtech press, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/106/104/106104119/ (Biometric Controls)
2. https://nptel.ac.in/courses/106/106/106106178/ (Information and Network Security)

21PCP314 **DEEP LEARNING** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn the fundamentals of deep learning.
- Understand the use various deep learning algorithms.
- Understand the CNN and RNN to model for real world applications.
- Study the deep learning Generative model and deep learning applications.
- Describe Convolutional Neural Networks.

UNIT I : INTRODUCTON TO DEEP LEARNING **9**

Introduction to Deep Learning: Basics: Biological Neuron, Idea of computational units, McCulloch– Pitts unit and Thresholding logic, Linear Perceptron, Perceptron Learning Algorithm, Linear separability,Convergence theorem for Perceptron Learning Algorithm.

UNIT II : CONVOLUTIONAL NETWORKS **9**

Convolutional Networks: The Convolution Operation - Variants of the Basic Convolution Function - Structured Outputs - Data Types - Efficient Convolution Algorithms - Random or Unsupervised Features- LeNet, Alex Net.

UNIT III : RECURRENT NEURAL NETWORKS **9**

Recurrent Neural Networks: Bidirectional RNNs - Deep Recurrent Networks Recursive Neural Networks - The Long Short-Term Memory and Other Gated RNNs.

UNIT IV : DEEP GENERATIVE MODELS **9**

Deep Generative Models: Boltzmann Machines - Restricted Boltzmann Machines - Introduction to MCMC and Gibbs Sampling- gradient computations in RBMs - Deep Belief Networks- Deep Boltzmann Machines.

UNIT V : DEEP LEARNING APPLICATIONS **9**

Applications: Large-Scale Deep Learning - Computer - Speech Recognition - Natural Language Processing - Other Applications.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students will be able to:

- Understanding the basics concepts of deep learning.
- Emphasizing knowledge on various deep learning algorithms.
- Understanding of CNN and RNN to model for real world applications.
- Understanding the various challenges involved in designing deep learning algorithms for varied applications.
- Analyze Convolutional Neural Networks.

TEXT BOOKS

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Bengio, Yoshua. "Learning deep architectures for AI - Foundations and trends in Machine Learning 2.1" , 2009.

REFERENCES

1. N.D.Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016.
2. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106184/ (Deep Learning)
2. https://nptel.ac.in/courses/108/108/108108148/ (Neural Networks)

21PCP315 CYBER SECURITY STANDARDS AND AUDIT L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the fundamentals of cyber security.
- Identify how threats materialize into attacks.
- Typical threats, attacks and exploits and the motivations behind them.
- Develop strategies for cyber security and protecting critical infrastructure.
- Understand policies to mitigate cyber risks and digital signature.

UNIT I : INTRODUCTION TO CYBER SECURITY 9

Introduction -Computer Security - Threats - Harm - Vulnerabilities - Controls - Authenticate Access Control and Cryptography - Web—User Side - Browser Attacks - Web Att Targeting Users - Obtaining User or Website Data - Email Attacks.

UNIT II : DEFENCES: SECURITY COUNTER MEASURES 9

Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT III : MANAGEMENT AND INCIDENTS 9

Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Economics - Electronic Voting - Cyber Warfare- Cyberspace and the Law - International Laws – Cyber Crime - Cyber Warfare and Home Land Security.

UNIT IV : STRATEGIES FOR CYBER SECURITY 9

Creating a Secure Cyber, Types of Attacks, Comparison of Attacks, Creating an Assurance Framework, Encouraging Open Standards, Strengthening the Regulatory framework, Creating Mechanisms for IT Security, Securing E-Governance Services, and Protecting Critical Information Infrastructure.

UNIT V : POLICIES TO MITIGATE CYBER RISK 9

Promotion of R&D in Cyber security, Reducing Supply Chain Risks, Mitigate Risks through Human Resource Development, Creating Cyber security Awareness, Information sharing - Implementing a Cyber security Framework. SIGNATURES - Digital Signature, Electronic Signature, Digital Signature to Electronic.

TOTAL: 45 PERIODS

OUTCOMES

After completing this course, students will be able to:

- Understanding the basics concepts of cyber security.
- Emphasizing knowledge of preventing into the attack.
- Understanding the knowledge of management incidents.
- Ability to apply various national, international laws and legal frameworks emphasizing responsibility and accountability at all levels in the organization.
- Understand policies to mitigate cyber risks and digital signature.

TEXT BOOKS

1. Charles P.fleeger, Shari Lawrence P fleeger and Jonathan Margulies, "Security in Computing", 5th Edition, Pearson Education, 2015
2. George K.Kostopoulous, "Cyber Space and Cyber Security", CRC Press, 2013.

REFERENCES

1. Peter Trim and Yang-Im Lee, "Cyber Security Management- A Governance, Risk and Compliance Framework", Gower Publishing, England ,2014.
2. Stuart Broderick J, "Cyber Security Program", Cisco Security Solutions, June 2016.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105162/ (Cryptography and Network Security)
2. https://onlinecourses.swayam2.ac.in/nou21_ge40/preview (Cyber security and Counter Measures)

SEMESTER I

21PSM101 ADVANCED MATHEMATICS FOR STRUCTURAL ENGINEERING L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Describe basic concepts about Laplace series and Laplace transforms.
- Evaluate boundary value problems associated with engineering applications using transform methods.
- Solve problems involving functional that occurs in various branches of engineering disciplines.
- Classify conformal mappings and their applications to fluid flows and heat flows.
- Differentiate various tensors that occur in engineering problems.

UNIT I: LAPLACE TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

Analysis Laplace transform properties – Transform of Error function, Bessel's function, Dirac delta function and Unit step function – Complex inversion formula – Solution of Diffusion equation – Solution of Wave equation.

UNIT II: FOURIER TRANSFORM TECHNIQUES FOR PARTIAL DIFFERENTIAL EQUATIONS 9+3

Fourier transform pairs – Properties of Fourier transform – Transform of elementary functions – Convolution theorem – Parseval's relation – Transform of Dirac delta function – Solution of Diffusion equation – Solution of Wave equation – Solution of Laplace equation.

UNIT III: CALCULUS OF VARIATIONS 9+3

Concept of variation and its properties – Euler's equation – Functional dependent on first and higher order derivatives – Functionals dependent on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods – Ritz and Kantorovich methods.

UNIT IV: CONFORMAL MAPPING AND APPLICATIONS 9+3

Introduction to conformal mappings and bilinear transformations – Schwarz Christoffel transformation – Transformation of boundaries in parametric form – Physical applications: Fluid flow and heat flow problems.

UNIT V: NUMERICAL INTEGRATION AND TENSOR ANALYSIS 9+3

Gaussian quadrature – Gauss-Hermite quadrature – Gaussian quadrature for double integral approximation – Summation convention – Contravariant and covariant vectors – Christoffel symbols.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply Laplace and Fourier transforms to initial value, initial–boundary value and boundary value problems in Partial Differential Equations.
- Differentiate maximize and minimize the functional that occur in various branches of engineering disciplines.
- Construct conformal mappings between various domains and use of conformal mapping in studying problems in physics and engineering particularly to fluid flow and heat flow problems.
- Classify tensor algebra and its applications in applied sciences and engineering and develops ability to solve mathematical problems involving tensors.
- Use Numerical integration and tensor analysis as a tool in the field of applied sciences and related fields.

TEXT BOOKS

1. Sankara Rao, K., “Introduction to Partial Differential Equations”, Prentice Hall of India Pvt. Ltd., 3rd Edition, 2015.
2. Filip Rindler, “Calculus of Variations", Springer, 1st Edition New York, 2018.

REFERENCES

1. Lokenath Debnath & Dambaru Bhatta, "Integral Transforms and Their Applications”, Chapman & Hall/CRC, 2nd Edition, 2016.
2. Taha Sochi, " Principles of Tensor Calculus”, Create Space Independent Publishing Platform, 1st Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/111/105/111105123/ (Transform Calculus and its applications in Differential Equations)
2. https://nptel.ac.in/courses/111/104/111104025/ (Calculus of variations and Integral Equations)

21PGT101	RESEARCH METHODOLOGY AND IPR (Common to all PG Engineering Courses)	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Identify problem formulation, analysis and solutions.
- Know the effective literature study approaches.
- Write Technical papers / presentations without violating professional ethics.
- Understand the process of process and procedure of patenting.
- Gain basic knowledge on intellectual property rights.

UNIT I: RESEARCH PROBLEM **9**

Meaning of research problem – Sources of research problem – Criteria characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem – Approaches of investigation of solutions for research problem – Data collection – Analysis – Interpretation – Necessary instrumentations

UNIT II: LITERATURE REVIEW **9**

Effective literature studies approaches – Analysis – Plagiarism and research ethics.

UNIT III: TECHNICAL WRITING /PRESENTATION **9**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee**.**

UNIT IV: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Nature of Intellectual Property – Patents, Designs – Trade and Copyright – Process of Patenting and Development: technological research – Innovation, patenting, development – International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents, Patenting under PCT.

UNIT V: INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications – New Developments in IPR: Administration of Patent System – IPR of Biological Systems, Computer Software etc – Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Formulate research problems.
- Carry out research analysis.
- Write technical papers/presentations.
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow the world will be ruled by ideas, concepts, and creativity.
- Understand about IPR and filing patents in R & D.

TEXT BOOKS

1. Ranjith Kumar, "Research Methodology: A step–by–step guide for beginners", SAGE Publications, 4th Edition, 2014.
2. Neeraj Pandey, Khushdeep Dhrani, "Intellectual Property Rights", PHI Learning Private Limited, 2014.

REFERENCES

1. Heather Silyn–Roberts, "Writing for Science and Engineering: Papers, Presentations and Reports", Elsevier, 2nd Edition, 2013.
2. Douglas C. Montgomery, "Design and Analysis of Experiments", 9th Edition, Wiley Publishers, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/121/106/121106007/ (Introduction to Research)
2. https://nptel.ac.in/courses/109/106/109106137/ (IPR)

21PST101 **APPLIED ELASTICITY AND PLASTICITY** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study the classical theory of linear elasticity for two and three dimensional state of stress.
- Have knowledge about elasticity solution.
- Obtain solutions for elasticity problems in polar coordinates.
- Introduce the energy principles and energy method of solution of solid continuum mechanics.
- Understand the plastic stress strain relations and criteria of yielding.

UNIT I: ELASTICITY **9**

Analysis of stress and strain, Equilibrium equations – Compatibility equations – Principal strain – Principle of superposition – Stress strain relationship – Generalized Hooke's law – Lame's constants – Differential equations of equilibrium in two and three dimensions in Cartesian coordinates.

UNIT II: TWO DIMENSIONAL PROBLEMS IN CARTESIAN COORDINATES **9**

Plane stress and plane strain – Methods of formulation of elasticity problems – Methods of solution of elasticity problems – Airy's Stress Function – Polynomials – Direct method of determining Airy's Stress Function – Simple two-dimensional problems in Cartesian coordinates.

UNIT III: TWO DIMENSIONAL PROBLEMS IN POLAR COORDINATES **9**

General equations in polar coordinates – Stress distribution symmetrical about an axis – Pure bending of curved bars – Strain components in polar coordinates – Displacements for symmetrical stress distribution – Rotating Disc – Thick Cylinder under Uniform Pressure.

UNIT IV: TORSION AND ENERGY METHODS **9**

Torsion of Prismatic bars – St.venant's approach – Prandtl's approach: Membrane analogy – Torsion of thin walled open and closed sections – Strain energy – Principle of virtual work – Energy theorems – Rayleigh Ritz method – Finite difference method – Application to elasticity problems.

UNIT V: PLASTIC DEFORMATION **9**

Physical Assumptions – Yield Criteria – Von Misses Yield Criterion – Tresca Yield Criterion – Failure Theories – Applications of Thick Cylinder – Plastic Stress Strain Relationship (Flow Rule) – Strain hardening – Elasto-Plastic Problems in Bending and Torsion.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Analyze the stresses and strains.
- Obtain solutions for elasticity problems in Cartesian coordinates.
- Interpret the induced stress in the two dimensional problems in polar coordinates.
- Analyze the beams and columns using energy methods.
- Obtain deformations by applying plasticity theory.

TEXT BOOKS

- Chandramouli P.N., “Theory of Elasticity”, Yesdee Publishing Pvt. Ltd., 1st Edition, 2017.
- Jane Helena H., “Theory of Elasticity and Plasticity”, Prentice Hall Publication, 1st Edition, 2017.

REFERENCES

1. Sadhu Singh, “Theory of Elasticity”, Khanna Publishers, 10th Edition, 2018.
2. Timoshenko, S. and Goodier J.N., "Theory of Elasticity", McGraw Hill Book Co, 3rd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/105/105105177/ (Theory of Elasticity)
2. https://nptel.ac.in/courses/105/108/105108070/ (Applied Elasticity for Engineers)

21PST102	FINITE ELEMENT ANALYSIS AND METHODS (Lab Component Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Develop the skills in finite element method.
- Describe the properties of various elements.
- Derive one dimensional element properties.
- Derive two and three dimensional element properties.
- Understand specifically the conception of an idea that involved in the finite element analysis of frames.

UNIT I: INTRODUCTION **9**

Finite Element method – History and Applications – Basic steps in finite element analysis – Boundary value problems – Approximate solutions – Variational and weighed residual methods – Rayleigh Ritz and Galerkin formulations – Spring and Bar Elements – Minimum Potential Energy Principle – Weak formulation.

UNIT II: ELEMENT PROPERTIES **9**

Discretization – Displacement model – Element properties – Lagrange and Serendipity Elements – Solid Elements – Iso-parametric Formulation – Stiffness Matrix of Iso-parametric Elements –Triangular Elements – Rectangular Elements – 3D Brick Elements – Elements for Fracture Analysis – Plate bending elements – Thick plate elements.

UNIT III: ONE DIMENSIONAL PROBLEMS **9**

One dimensional problems – Coordinate systems – Global, local and natural coordinate systems – Shape functions – Bar, beam and truss element – Generation of Stiffness Matrix and Load Vector – Application to trusses, beams and plane frames – Convergence requirements, P and H methods.

UNIT IV: FEM FOR TWO AND THREE–DIMENSIONAL SOLIDS **9**

Constant Strain Triangle – Linear Strain Triangle – Numerical Evaluation of Element Stiffness – Computation of Stresses, Geometric Nonlinearity and Static Condensation – Axisymmetric Element – Finite Element Formulation of Axisymmetric Element – Finite Element Formulation for 3 Dimensional Elements – Problems.

UNIT V: ANALYSIS OF FRAMED STRUCTURES **9**

Stiffness of Truss Member – Analysis of Truss – Stiffness of Beam Member – Finite Element Analysis of Continuous Beam – Plane Frame Analysis – Analysis of Grid and Space Frame – Solution for simple frames.

LIST OF EXPERIMENTS

1. Introduction of structural Analysis software Programming in Excel for model analysis.
2. Modeling using STAAD and dynamic analysis.
3. RCC and Steel design.
4. Finite element modeling.
5. Stability analysis using FEM.
6. Finite Element Analysis of thin and thick plates.

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the energy principles and finite element concepts.
- Apply the knowledge on element properties to solve various problems.
- Execute finite element analysis concept in one dimensional element problems.
- Apply the finite element analysis concept in two and three dimensional element problems.
- Analyze the framed structures.

TEXT BOOKS

1. Nam H Kim, bhavani V.Sankar & Ashok V.Kumar, "Introduction to Finite Element Analysis", 2nd Edition, Wiley Publishers, 2018.
2. Chandrupatla.R.T. and Belegundu.A.D., "Introduction to Finite Elements in Engineering", Pearson Education, 4th Edition, 2016.

REFERENCES

1. Ioannis Koutromanos, "Fundamentals of Finite Element Analysis", 1st Edition, Wiley Publishers, 2018.
2. Reddy, J.N, "An Introduction to the finite element method", McGraw Hill International Edition, 3rd Edition 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/112/104/112104193/ (Basics of Finite Element Analysis – I)
2. https://nptel.ac.in/courses/112/104/112104116/ (Finite Element Method)

21PSE101	EXPERIMENTAL TECHNIQUES (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Access the errors in measurement and learn the principles of measurement.
- Use vibrating measuring instruments and digital and electronic display.
- Access the wind flow measurement and pressure measurement and scale different models.
- Learn the damage assessment.
- Study about the NDT methods.
- Operate Non-Destructive Technique equipments properly.

UNIT I: FORCE AND STRAIN MEASUREMENTS **9**

Basic Choice of Experimental stress analysis methods, errors in measurements – Strain gauge – Principle – Types, performance and uses – Hydraulic jacks and pressure gauges – Electronic load cells and Proving Rings – Calibration of Testing Machines – Long–term monitoring – Vibrating wire sensors – Fibre optic sensors.

UNIT II: MEASUREMENT OF VIBRATION **9**

Characteristics of structural vibration – Linear variable differential transformer (LVDT) – Transducers for Velocity and acceleration measurements – Vibration meter – Seismographs – Vibration analyzer – Display of recording of signals – Cathode ray oscilloscope – XY plotter – Chart plotters – Digital data acquisition systems

UNIT III: ACOUSTICS AND WIND FLOW MEASUREMENTS **9**

Principles of pressure and flow measurements – Pressure transducer – Sound level meter – Wind tunnel and its use in structural analysis – Structural modeling – Direct and indirect model analysis – Application to structural problems – Testing of Transmission line towers – Acoustic emission

UNIT IV: DISTRESS MEASUREMENTS & CONTROL **9**

Diagnosis of distress in structures – Crack observation and measurements – Corrosion of reinforcement in concrete – Half cell, construction and use – Damage assessment – Controlled blasting for demolition – Techniques for residual stress measurements.

UNIT V: NON–DESTRUCTIVE TESTING TECHNIQUES **9**

Load testing of structures, Buildings, bridges and towers – Rebound Hammer – Ultrasonic Testing, Principles and applications – Moire fringes – brittle coatings – Holography – Use of Lasers for structural testing – GECOR and GPR.

LIST OF EXPERIMENTS

1. Strain gauge meter – Determination of Young's modulus of a metallic wire
2. Ultrasonic interferometer – ultrasonic velocity in liquids
3. Electrical conductivity of metals and alloys with temperature–four probe method
4. Resistivity measurements
5. NDT – Ultrasonic flaw detector
6. Calibration of Proving Ring

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Perform force and strain measurement by selecting appropriate tools and technique.
- Use various vibration measuring instruments and analyze the structures using digital display unit.
- Apply model analysis as an effective experimental technique.
- Measure distress in the structures using various electronic equipments.
- Perform advanced NDT methods in accessing the load testing of structures.
- Perform NDT testing on concrete.

TEXT BOOKS

1. Karthik Selva Kumar Karuppasamy, "Applications and Techniques for Experimental Stress Analysis", IGI Global, 1st Edition, 2019.
2. Dally J.W. and Riley W.F., "Experimental Analysis", McGraw Hill Inc., 1st Edition, 2018.

REFERENCES

1. D.E.Bray and R.K.Stanley, "Non–Destructive Evaluation", McGraw Hill Publishing Co., 1st Edition, 2018.
2. Ganesan.T.P, "Model Analysis of Structures", Universities Press, 2nd Edition, 2015.

E–RESOURCES

1. https://nptel.ac.in/courses/112/107/112107242/ (Mechanical Measurement System)
2. https://nptel.ac.in/courses/112/106/112106068/ (Experimental Stress Analysis)

21PEE101 **RESEARCH PAPER WRITING AND SEMINAR** **L T P C**
1 0 0 0

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers).
4. Preparing a draft outline of research work.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Linking the papers and preparing a draft of the paper.
7. Preparing conclusions based on the reading of all the papers.
8. Writing the Final Paper and giving final Presentation.
9. Maintaining a file for records of activities.

Activities to be carried out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	1. Select an area of interest and topic. 2. State the objectives.	2nd week	**3%** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about the area & topic	1. List one special interest groups or professional society. 2. List two journals. 3. List two conferences, symposia or workshops. 4. List one thesis title. 5. List three web presences (mailing lists,forums,news sites) 6. List three authors who publish regularly in the area 7. Attach a call for papers (CFP) from the area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)

Collection of Journal papers in the topic in the context of the objective - collect 20 & then filter	• Provide a complete list of references based on the objectives • Search various digital libraries and Google Scholar • Collect recent papers related to research area so that to write a meaningful survey out of them, • Do a recent survey of the field. • Find relationships of base paper with respect to other literature concerned. (classification scheme / categorization). • Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered.	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? What did the author say were the important directions for future research?	5th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)

	Conclude with limitations/issues not addressed by the paper (from the perspective of the survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft outline for survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)

Sections of the paper	Write the sections of the paper based on the classification / categorization diagram in keeping with the goals of the survey.	11th week	**10%**(this component will be evaluated based on the linking and classification amongthe papers)
Conclusions	Write conclusions and future work.	12th week	**5%** (conclusions – clarity and ideas)
Final Draft	Complete the final draft of the paper.	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	Prepare for Final Presentation.	14th& 15th week	**10%** (based on presentation and viva-voce)

TOTAL: 30 PERIODS

SEMESTER II

21PST201 ADVANCES IN STEEL STRUCTURES L T P C
3 0 0 3

(IS 800:2007, IS 801:1975, IS805:1995, IS811:1987, IS875:1987 & SP 06 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Describe the general principle in the design of steel structures.
- Understand the design of purlins and girders.
- Find the suitable types of connections under various conditions.
- Analyze and design steel transmission line towers.
- Design of steel structures for fire, fatigue and understand the principles of earthquake resistant design.

UNIT I: DESIGN PHILOSOPHIES 9

Philosophies of Limits State Design, WSD and LRFD Concepts of Plastic design – Local Buckling of thin plate elements – Section Classification – Limit State Design – Comparison of BIS and other International codes – Behaviour and Limit state design of beam columns.

UNIT II: DESIGN OF PURLINS AND GIRDERS 9

Beams subjected to biaxial bending – Built–up Purlins – Various types and design – Design of Wind girders – Beam-columns – With various support conditions – Design of foundations with lateral forces.

UNIT III: DESIGN OF CONNECTIONS 9

Types of connections – Welded, bolted and riveted – Throat and root stresses in Fillet welds – Seated connections – Un-stiffened and stiffened seated connections – Moment resistant connections – Clip angle connections – Split beam connections – Framed connections.

UNIT IV: ANALYSIS AND DESIGN OF STEEL TOWERS 9

Micro Wave Towers – Transmission line towers – Loads on towers – Shape, Sag and Tension in Uniformly loaded conductors – Analysis of towers – Design of member in towers.

UNIT V: SPECIAL REQUIREMENTS OF DESIGN AND CONSTRUCTION 9

Fire resisting properties of steel – Principles of fire-resistant Design – Fatigue failures of steel structures – Principle of Fatigue-resistant Design As per IS code – Seismic Behaviour and advantages of steel – Principles of Earthquake resistant design of Steel Structures.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand various design philosophies as per various international codes.
- Design the steel members such as purlins, gable wind girders, base plates subjected to combined forces.
- Explain and design the different types of steel connections such as welded, bolted and moment resisting connections.
- Design high rise steel structures subjected to wind load.
- Design of steel structures for fire, fatigue and understand the principles of earthquake resistant design.

TEXT BOOKS

1. Duggal.S.K., "Limit State Design of Steel Structures", McGraw Hill Private Limited, 3rd Edition, 2019.
2. Subramanian N, "Design of Steel Structures", Oxford University Press, 2nd Edition, 2015.

REFERENCES

1. Dayaratnam P, "Design of Steel Structures", S. Chand & Company, 3rd Edition, 2017.
2. Ramchandra & Virendra Gehlot, "Design of Steel Structures"- 1 & 2, Scientific Publishers, 13th Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/105/105/105105162/ (Design of Steel Structures)
2. https://nptel.ac.in/courses/105/106/105106113/ (Design of Steel Structures – II)

21PST202 STRUCTURAL DYNAMICS AND SEISMIC DESIGN L T P C
3 0 0 3

(IS13920: 2016, IS13935: 2009, IS 1893: 2002 & IS 4326:1993 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Expose the principles and methods of dynamic analysis.
- Learn damped and Un–damped techniques.
- Analyze the various direct integration methods.
- Explain earthquake monitoring and seismic instrumentation, estimation of earthquake parameters.
- Design the earthquake resistant design buildings.

UNIT I: VIBRATION ANALYSIS 9

Vibration and its importance to structural engineering problems – Elements of vibratory systems and simple harmonic motion – Generalized mass – D'Alembert's principle – Equations of motion by equilibrium and energy methods, free and forced vibration of single degree of freedom systems – Effect of damping – Transmissibility.

UNIT II: TWO DEGREE OF FREEDOM SYSTEMS 9

Formulation of Structure – Equations of Motion of Two degree of freedom systems – Damped and un-damped free vibrations – Un-damped forced vibration – Normal modes of vibration – Applications.

UNIT III: DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 9

Introduction – Damping in MDOF systems – Non-linear MDOF systems – Direct integration methods – Wilson 'φ' method – New 'β' method – Measurement of damping and vibration techniques – Application of structural dynamics in the design of block and frame foundations.

UNIT IV: EARTHQUAKES AND GROUND MOTION 9

Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon) – Seismo–tectonics and Seismic Zoning of India – Earthquake Monitoring and Seismic Instrumentation – Characteristics of Strong Earthquake Motion – Estimation of Earthquake Parameters – Microzonation.

UNIT V: EARTHQUAKE RESISTANT DESIGN OF RC STRUCTURES 9

Earthquake Resistant Design of R.C.C. Buildings – Material properties – Lateral load analysis – Design and detailing – Rigid Frames – Shear wall – Coupled Shear wall

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the elements of vibratory systems and its importance in analysis.
- Apply the equation of motion to two degree of freedom systems.
- Analyze dynamic response by direct integration method.
- Describe ground motion and its relationship to seismic design of structures.
- Apply the basic principles of conceptual design for earthquake resistant RC building.

TEXT BOOKS

1. Anil K. Chopra, "Dynamics of Structures", Pearson Education, 3rd Edition, 2016.
2. H. R. Wason, M. L. Sharma, Manish Shrikhande. "Advances in Indian Earthquake Engineering and Seismology", Springer, 1st Edition, 2018.

REFERENCES

1. Martin Williams, "Structural Dynamics", CRC Press, 1st Edition, 2016.
2. S K Duggal, "Earthquake Resistant Design of Structures", Oxford University Press, 3rd Edition, 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106151/ (Structural Dynamics)
2. https://nptel.ac.in/courses/105/102/105102016/ (Seismic Analysis of Structures)

21PSE201	ADVANCES IN CONCRETE TECHNOLOGY (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Study the properties of concrete.
- Enable the students to design concrete mixes as per ACI and IS methods.
- Test the quality of concrete and stress strain characteristics as per IS provision.
- Understand various concrete manufacturing processes and concreting methods.
- Get an adequate knowledge about special concretes and their applications in the diverse construction field.
- Cast and test the structural beams and columns.

UNIT I: INTRODUCTION **9**

Concrete: Past, Present and Future – Constituent Materials –– Strength of Concrete – Dimensional Stability of Concrete – Chemical and Mineral Admixtures – Properties of fresh and hardened Concrete – Mineral additives.

UNIT II: MIX DESIGN **9**

Principles of Concrete Mix Design – Factors in the choice of mix proportions – Mix design methods – A.C.I Methods – I.S. Methods – Mix proportion – Correction for moisture content – Bulking – Yield of concrete – Design of High strength concrete and Self compacting concrete – EFNARC Specifications – Design of concrete mix with Fly ash and silica fume.

UNIT III: TESTING OF CONCRETE **9**

Workability – Compression – Tension – Flexure – Bond strength – Factors affecting the results – Accelerated strength results – Stress strain characteristics – Modulus of Elasticity – In situ strength determination – Variation in results – Distribution of strength – Standard deviation – Non destructive tests – I.S. code provision.

UNIT IV: CONCRETING METHODS **9**

Concrete manufacturing process – Stages of manufacturing – Transportation, placing and curing methods – Extreme weather concreting – Special concreting methods – Vacuum dewatering concrete – Underwater concreting – Special form work types.

UNIT V: SPECIAL CONCRETES **9**

Lightweight and Heavy Weight Concrete – High Strength Concrete – High Performance Concrete – Polymers in Concrete – Steel fiber Reinforced Concrete – Ferro cement Concrete – Vaccum Concrete – Shotcrete – Ready Mixed Concrete – Self compacting concrete – Geopolymer concrete.

LIST OF EXPERIMENTS

1. Casting and Testing of Simply Supported Reinforced Concrete beams for flexure.
2. Casting and Testing of Simply Supported Reinforced Concrete beams for shear.
3. Testing of Simply Supported Steel beams for flexure.
4. Casting and Testing of Reinforced Concrete columns.
5. Accelerated Corrosion Test on concrete.
6. Rapid Chloride Penetration Test.

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Find out the properties of fresh and hardened concrete.
- Design the concrete mix by various methods.
- Understand various testing of concrete and stress strain characteristics as per IS Code.
- Choose the correct concrete methods in the field depending upon the requirement and site conditions.
- Use suitable concrete for different structures considering the prevailing weathering conditions.
- Perform casting and testing in structural members.

TEXT BOOKS

1. Shetty M.S., Concrete Technology, S.Chand and Company Ltd., 8th Edition, 2019.
2. Krishnaraju, N., Advanced Concrete Technology, CBS Publishers, 4th Edition, 2018.

REFERENCES

1. Gambir,M.L. "Concrete Technology", Tata McGraw Hill, Publishing Co,Ltd, 6th Edition, 2017.
2. Santhakumar,A.R., Concrete Technology, Oxford University Press, 10th Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/105/102/105102012/ (Concrete Technology)
2. https://nptel.ac.in/courses/105/106/105106176/ (Advanced Concrete Technology)

21PEE201	MINI PROJECT	L T P C 0 0 2 1

OBJECTIVES

The main objective of this course is to:

- Design a structure using modern software tools available like ETABS, STAAD, STRAP etc. and present it in the form of complete detail drawing

GUIDELINES

Students have to work individually with standard codes, computational tools and software packages for analyzing, designing and detailing a structure. A detailed report on the work done shall be submitted by individual student in the form of a report and presentation.

TOTAL: 30 PERIODS

OUTCOMES

- At the end of the course project the students will have a clear idea of his/her area of work in Plan a layout of a structure, calculate loads using IS codes and various computational tools, Analyze the structure for various loads and load combination according to the relevant IS codes, design and detail structures using computer software/tools and check the correctness using manual approximate methods and prepare the complete structural drawings using computer software.

SEMESTER III

21PEE301	PROJECT WORK (PHASE–I)	L T P C 0 0 12 6

OBJECTIVES

The main objective of this course is to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- Develop the methodology to solve the identified problem.
- Train the students in preparing project reports and to face reviews and viva– voce examination.

GUIDELINES

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva–voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOMES

- At the end of the course project the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

SEMESTER IV

21PEE401	PROJECT WORK (PHASE – II)	L T P C 0 0 24 12

OBJECTIVES

The main objective of this course is to:

- Solve the identified problem based on the formulated methodology.
- Develop skills to analyze and discuss the test results, and make conclusions.
- Train the students in preparing project reports and to face reviews and viva– voce examination.

GUIDELINES

The student should continue the phase–I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

OUTCOMES

- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

SEMESTER I

PROFESSIONAL ELECTIVE I

21PSP101	**DISASTER RESISTANT STRUCTURES**	**L T P C** **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Understand the design philosophy for loads, earthquake and wind.
- Conduct safety and risk assessment in structures.
- Study damage assessment and retrofitting.
- Understand materials, design and detailing for life line structures.
- Apply the advanced techniques for damage assessment.

UNIT I: BEHAVIOUR OF LIFE LINE STRUCTURES **9**

Design philosophy to resist flood, cyclone, and earthquake and fire disasters – National and International Codes of practice – By-laws of urban and semi-urban areas – Past history and lessons from disasters – Approach to traditional and Modern Structures.

UNIT II: RISK ASSESSMENT OF STRUCTURES **9**

Safety analysis and rating – Reliability assessment repairs and Retrofitting techniques of Community Structures – Protection of Nuclear Structures – Dams, bridges and buildings..

UNIT III: REHABILITATION AND RETROFITTING **9**

Testing and evaluation – Classification according to safety level – Methods and materials for strengthening for different disasters – Qualification test – Dynamic impact analysis.

UNIT IV: MATERIALS, DESIGN AND DETAILING **9**

Modern Materials for disasters reduction – Detailing aspects of structures subject to probable disasters – Construction techniques – Analysis methodology – Techniques for optimal performance – Provisions for artificial disasters – Blast and impact.

UNIT V: TECHNIQUES OF DAMAGE ASSESSMENT **9**

Damage surveys – Maintenance and modification to improve hazard resistance – Application GIS in disaster management – Foundation improvement techniques.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Explain the design philosophy of Disaster Resistant Structures.
- Conduct risk assessment in disaster resistant structures.
- Use retrofitting methods to resist disasters.
- Utilize the modern materials for disaster reduction.
- Apply GIS in disaster management.

TEXT BOOKS

1. D. N. Shaw, R T L Allen, S C Edwards, "Repair of Concrete Structures", Taylor & Francis Group, 2nd Edition, 2019.
2. M. M. Sulphey, "Disaster Management", Prentice Hall India Pvt., Limited, 1st Edition, 2016.

REFERENCES

1. Poonam I. Modi, Chirag N. Patel, "Repair and Rehabilitation of Concrete Structures", Prentice Hall India Pvt. Limited, 1st Edition, 2016.
2. Sekhar Chandra Dutta, Parthasarathi Mukhopadhyay, "Improving Earthquake and Cyclone Resistance of Structures", Energy and Resources Institute, 2nd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/107/105107204/ (Introduction to DRS)
2. https://nptel.ac.in/courses/105/101/105101004/ (Introduction to Earthquake Engineering)

21PSP102	THEORY OF STRUCTURAL STABILITY	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study the stability of columns using theoretical and numerical methods.
- Understand the approximate methods and numerical methods of inelastic buckling.
- Get accustomed to beam column behavior and that of frames.
- Identify the buckling of columns.
- Understand energy methods.

UNIT I: STABILITY OF COLUMNS **9**

Fundamental concepts – Elastic structural stability – Structural instability – Analytical methods for the stability Analysis, equilibrium, imperfections and energy methods – Non-prismatic columns – Built up columns – Buckling modes Effect of shear on buckling load – Large deflection theory.

UNIT II: METHODS OF ANALYSIS AND INELASTIC BUCKLING **9**

Approximate methods – Rayleigh and Galerkin methods – Numerical methods – Finite difference and Finite Element – Analysis of columns – Experimental study of column behavior – South well plot – Column curves

UNIT III: BEAM COLUMNS AND FRAMES **9**

Beam-column behavior – Standard cases – Continuous columns and beam-columns – Columns on elastic foundation – Buckling of frames – Single storey portal frames with and without side sway – Classical and stiffness methods – Use of Wood's charts.

UNIT IV: BUCKLING OF BEAMS **9**

Lateral buckling of beams – Energy method – Application to symmetric and single symmetric I beams – Simply supported and cantilever beams – Narrow rectangular cross sections – Numerical solutions – Torsional buckling.

UNIT V: BUCKLING OF THIN PLATES **9**

Isotropic rectangular plates – Governing Differential equations – Simply supported on all edges – Use of energy methods – Numerical techniques.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply structural stability and instability concepts for designing column.
- Use appropriate methods for analyzing columns.
- Assess the Experimental study of column.
- Calculate lateral buckling of beams.
- Study various numerical techniques and energy methods for buckling of thin plates. Model the pre cracked element numerically.

TEXT BOOKS

1. Timoshenko, S.P. and Gere J.M., "Theory of Elastic Stability", McGraw Hill Book Company, 2nd Edition, 2016.
2. Sukhvarsh Jerath, "Structural Stability Theory and Practice", Wiley Publishers, 1st Edition, 2021.

REFERENCES

1. Shanmugam N.E. & Wang C.M., "Analysis and Design of Plated Structures Vol 1: Stability", Elsevier, 2nd Edition, 2021.
2. Galambos T.V, "Structural members and frames", Dover Publications Inc, 1st Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/105/108/105108141/ (FEM for Vibration and Stability analyses)
2. https://nptel.ac.in/courses/112/103/112103251/ (Theory of Rectangular Plates – Part – I)

21PSP103 ADVANCES IN CONCRETE STRUCTURES L T P C
3 0 0 3

(IS456: 2000, IS 1893: 2002, IS5525: 1969 & SP34 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Understand the basic concepts of reinforced concrete members.
- Design slender columns, R.C walls and Corbels.
- Describe the concept of shear reinforcement and edge beams.
- Apply plastic design in concrete structures.
- Design and detail the structures according to different codes.

UNIT I: INTRODUCTION **9**

Review of Basic Concepts – Behavior and Design of Reinforced Concrete members considering flexure, Torsion, combined with flexure and flexural shear, axial compression deflection and crack width as per IS 456: 2000.

UNIT II: DESIGN OF SPECIAL R.C. ELEMENTS **9**

Behavior and Design of Slender Columns – Design of R.C.Walls – Ordinary and Shear walls – Design of Corbels – Deep beams and grid floors

UNIT III: FLAT SLABS AND FLAT PLATES **9**

Design of flat slabs and flat plate according to ACI method – Design of shear – Reinforcement and Edge (Spandrel) beams – Yield line theory & Hiller borg method of design of slabs.

UNIT IV: MOMENT REDISTRIBUTION **9**

Limit Analysis of Concrete beams – Moment rotation curves – Moment redistribution in continuous beams – Baker's method of plastic design – Design of cast in-situ frames.

UNIT V: DESIGN AND DETAILING OF STRUCTURES **9**

Detailing for ductility – Fire Resistance of buildings – Field control of concrete – Strengthening of existing structures – Design and detailing of structures according to different codes

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Explain the behaviour and design concept of reinforced concrete members.
- Design slender columns, R.C. walls and corbels.
- Design flat slab and flat plates according to ACI methods.
- Apply moment redistribution in continuous beams.
- Design and detail Fire Resistant buildings.

TEXT BOOKS

1. N. K. Raju, "Advanced Reinforced Concrete Design", CBS PUB & DIST PVT Limited INDIA, 1st Edition, 2016.
2. Pillai.S.V and Menon.D, "Reinforced Concrete Design", Tata McGraw Hill Book Co., first Edition, 2016.

REFERENCES

1. Macginley.T.J. and Choo B.S., Reinforced Concrete Design Theory and Examples, CRC Press, 1st Edition, 2018.
2. David A. Fanella, "Reinforced Concrete Structures: Analysis and Design", McGraw-Hill Education, 1st Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106176/ (Advanced Concrete Technology)
2. http://www.nptelvideos.in/2012/11/ (design of reinforced concrete structures.html)

21PSP104 **SMART MATERIALS FOR CONSTRUCTION** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Choose a suitable concrete admixture.
- Design steel–concrete composite elements.
- Design fiber reinforced concrete mix as per ACI standards.
- Identify the structure and characteristics of geo-polymer concrete.
- Understand the mechanical properties of ferro cement.

UNIT I: CONCRETE ADMIXTURES **9**

Mineral (pozzolanic materials and fillers) – Chemical (accelerators, retarders, plasticizers, super plasticizers, air entraining agent, viscosity modifier, corrosion inhibitors and water repellent) – Dosage – Compatibility.

UNIT II: STEEL CONCRETE COMPOSITE **9**

Introduction to steel-concrete composite structures – Anatomy of a composite building – Construction of composite structures – Design of composite beam and column – Shear connectors – Design strength of shear connectors – Load resisting systems connections – Analysis procedures of buildings for gravity and lateral loads.

UNIT III: FIBER REINFORCED CONCRETE **9**

Fibre materials – Mix proportioning – Distribution and orientation – Interfacial bond – Properties in fresh state – Strength and behaviour in tension, compression and flexure of steel fibre reinforced concrete – Mechanical properties – Crack arrest and toughening mechanism – Applications of FRC – Design as per ACI 544.4R-18 Case study.

UNIT IV: GEO–POLYMER CONCRETE **9**

Characterisation – Activating solution – Structure of geopolymers – Accelerated curing – Durability – Design – Engineering properties – Applications – Case study.

UNIT V: FERROCEMENT **9**

Ferro cement: ferrocement materials – Mechanical properties – Cracking of ferrocement – Strength and behaviour in tension – Compression and flexure – Design of ferrocement in tension – Ferrocement constructions, durability and applications.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Use suitable admixtures for concrete.
- Design steel concrete composite structures.
- Design fibre reinforced concrete as per ACI 544.
- Use Geo-polymer Concrete in fields.
- Understand the behaviour and design of ferrocement.

TEXT BOOKS

1. A.M Paillere, "Applications of Admixtures in Concrete", CRC Press, 1st Edition, 2019.
2. Johnson R.P. and Wang Y.C., "Composite Structures of Steel and Concrete", Wiley Publishers, 1st Edition, 2018.

REFERENCES

1. Harvinder Singh, "Steel Fiber Reinforced Concrete", Springer, 1st Edition, 2017.
2. Stanley Abercrombie, "Ferrocement: Building with cement, sand, and wire mesh", Hill Family Books, 1st Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/112/104/112104251/ (Smart materials intelligence system)
2. https://nptel.ac.in/courses/105/102/105102195/ (Sustainable Materials and Green Buildings)

21PSP105 CRACKS AND CRACK CONTROL IN CONCRETE STRUCTURES L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Equip with properties and Microstructure of concrete.
- Impose knowledge of various durability and corrosion behavior of concrete.
- Classify the different types of cracks due to any type of force including earthquake force and other factors.
- Understand the long term effects of cracking.
- Understand advanced crack control and repair techniques.

UNIT I: PROPERTIES OF CONCRETE 9

Historical note on Portland Cement Concrete – Basic properties of plain concrete – Microstructure – Shrinkage, creep and strength of concrete – Temperature effect on concrete – Transport properties of concrete – Tensile, shear, bend and torsional strength of plain and reinforced concrete.

UNIT II: DURABILITY OF CONCRETE 9

Durability of concrete causes for inadequate durability of concrete chloride diffusion – Carbonation of concrete – Sulphate attack – Acid attack on concrete – Alkali-Silica reaction – Abrasion resistance – Fire resistance – Erosion resistance – Cavitations' – Flame resistance – Corrosion resistance – Chemical resistance of concrete and other durability tests methods on concrete.

UNIT III: THEORY OF CRACKS 9

Heat gain and loss phenomenon in buildings – Thermal performance parameters – Role of building enclosures, Openings and materials in thermal environment – Basic principles of light and daylight – Energy efficient light design of buildings – Daylight design of buildings.

UNIT IV: PROPERTIES OF CRACKS 9

Long term effects of cracking – Material and loading effects – Creep effect – Bond – Slip theory – Straight line theory – Flexural stiffness – Effective moment of inertia – Computation of deflection due to short term and long term – Computation of crack width and crack spacing – Limiting crack width – Pressure grouting methods and procedures.

UNIT V: CRACK DETECTION AND CONTROL 9

Crack detection – Crack measuring techniques – Control of cracking in plain and reinforced concrete beams and columns – Crack control by material selection – Crack reduction designs and construction practices – Advanced crack control and repair techniques – Crack detection devices.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Gain the knowledge of properties and micro structure of concrete.
- Get exposed to durability of concrete and corrosion behavior.
- Use heat gain and loss phenomenon for identification of cracks.
- Understand the long term effects of cracking.
- Understand the Crack measuring techniques.

TEXT BOOKS

1. Sandor Popovics, "Concrete Materials: Properties, Specifications, and Testing", Noyes Publications, 2nd Edition, 2017.
2. Prashanth kumar., "Elements of Fracture Mechanics", by Wheeler Publishing Company, New Delhi, 3rd Edition, 2017.

REFERENCES

1. Srinath L.S., "Advanced mechanics of Solids", Tata Mcgraw–hill Publishing Company Ltd, New Delhi, 3rd Edition, 2017.
2. Francis Barre, Philippe Bisch, "Control of Cracking in Reinforced Concrete Structures", Wiley Publishers, 1st Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/112/106/112106065/ (Engineering Fracture Mechanics)
2. https://nptel.ac.in/courses/105/106/105106202/ (Maintenance and Repair of Concrete Structures)

SEMESTER II

PROFESSIONAL ELECTIVE II

21PSP201	**FORMWORK ENGINEERING** (IS 14687: 1999 are to be permitted)	**L T P C** **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Describe the materials and behavior of formwork.
- Identify various loads acting on formwork and design foundation formwork.
- Design formwork for wall and column.
- Understand the formwork for beam and slab.
- Design the Flying Formwork slips form techniques.

UNIT I: INTRODUCTION **9**

Introduction – Formwork as a temporary structure – Requirements for Formwork – Selection of Formwork – Classification of Formwork – Formwork Materials – Timber – Plywood – Steel – Aluminium Form – Plastic Forms – Other Material – Form Coating and Mould Linings – Form Anchors – Tie System – Spreaders, Spacers – Form Linings Materials.

UNIT II: FORMWORK DESIGN CONCEPTS & FOUNDATION FORMWORK **9**

Loads on Formwork – Dead or Permanent Loads – Imposed Loads – Environmental Loads – Design Basis (Assumption Made in Formwork Design) – Estimating Permissible Stress – Maximum Bending Moment, Shear Force, and Deflection – Formwork for Foundation – Conventional Formwork for Foundation – Foundation Formwork (All Steel) – Foundation Formwork Design – Illustration on Foundation Wall Design.

UNIT III: WALL & COLUMN FORMWORK **9**

Wall Formwork – Conventional Wall Formwork – Proprietary Wall Formwork System – Large Area Wall Forms – Climbing Formwork Wall Formwork – Wall Form Design – Illustration of Wall Formwork Design Using Plywood and H-16 Beams – Column Formwork – Conventional Column Formwork – Proprietary Column Formwork – Column Formwork System.

UNIT IV: SLAB AND BEAM FORMWORK **9**

Traditional Slab and Beam Formwork – Slab and Beam Formwork Solutions offered by L&T – Beam and Slab – Formwork Solution by PERI and Mivan – Achieving Economy In Slab Construction – Design of Slab and Beam Construction – Illustration of Slab and Beam Formwork Design – Illustration of Proprietary Slab Formwork.

UNIT V: FLYING FORMWORK **9**

Some Examples of Flying Formwork – Flying Formwork Cycle – Advantages and Limitation of Flying Formwork – Design Issues In Flying Forms – Safety Issues in Flying Forms – Table Forms – Tunnel Formwork System – Column Mounted Shoring System – Gang Forms – Slip form.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Describe the requirements and classification of formwork.
- Gain the knowledge of Bending Moment, Shear Force, and Deflection.
- Perform wall and column formwork.
- Utilize the Slab and Beam Formwork Solutions offered by L&T.
- Design Flying Formwork slip form techniques as per codal provisions.

TEXT BOOKS

1. R. L. Peurifoy, "Formwork for Concrete Structures", McGraw Hill India, 6th Edition, 2016.
2. Kumar Neeraj Jha, "Formwork for Concrete Structures", Tata McGraw Hill Education, 2nd Edition, 2018.

REFERENCES

1. Janardan Jha, "Modern Practices in Formwork for Civil Engineering Construction Works", University Science Press, 2nd Edition, 2018.
2. P.S.McAdam and G.W.Lee, "Formwork: A Practical Guide", CRC Press, 1st Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/104/105104030/ (Concrete Engineering and Technology)
2. https://nptel.ac.in/courses/105/102/105102088/ (Formwork)

21PSP202	DESIGN OF INDUSTRIAL STRUCTURES (IS 800: 2007, IS 801, IS 811 & SP06 are to be permitted)	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Form the layout requirement regarding lighting and ventilation.
- Design the various industrial buildings.
- Study the power plant structures.
- Analyse the power transmission structures.
- Design the auxiliary structures.

UNIT I: PLANNING AND FUNCTIONAL REQUIREMENTS **9**

Classification of Industries and Industrial structures – Planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety – Protection against noise and vibration – Guidelines of Factories Act.

UNIT II: INDUSTRIAL BUILDINGS **9**

Roofs for Industrial Buildings – Steel and RCC – Gantry Girders – Design of Corbels and Nibs – Machine foundations

UNIT III: POWER PLANT STRUCTURES **9**

Introduction – Types of power plants – Design of Turbo generator foundation – Containment structures.

UNIT IV: POWER TRANSMISSION STRUCTURES **9**

Introduction – Transmission Line Towers – Substation Structures – Tower Foundations – Testing Towers

UNIT V: AUXILLIARY STRUCTURES **9**

Chimneys and cooling Towers – Bunkers and Silos – Pipe supporting structures

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the planning and functional requirements of various industries
- Design gantry girders, corbels and nibs for industrial buildings.
- Apply the basic concepts in the design of power plant structures.
- Design power transmission structures.
- Design the chimneys and cooling Towers.

TEXT BOOKS

1. P.Srinivasulu and C.Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 3rd Edition, 2018.
2. Manohar S.N, "Tall Chimneys – Design and Construction", Tata McGraw Hill, 2nd Edition, 2018.

REFERENCES

1. Santhakumar A.R.and Murthy S.S., "Transmission Line Structures", Tata McGraw Hill, 4th Edition, 2017.
2. Jurgen Axel Adam, Katharria Hausmann, Frank Juttner, Klauss Daniel, "Industrial Buildings:A Design Manual", Birkhauser Publishers, 6th Edition, 2016.

E-RESOURCES

1. https://nptel.ac.in/courses/105/106/105106113/ (Design of Steel Structures II)
2. https://nptel.ac.in/courses/105/105/105105162/ (Design of Steel Structures)

21PSP203	STRUCTURAL HEALTH MONITORING	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the fundamentals of health monitoring of structures.
- Use structural audit for health assessment of structures.
- Apply static field methods as tool of SHM.
- Employ dynamic field tests to assess the structure.
- Apply advanced concepts for structural health monitoring.

UNIT I: STRUCTURAL HEALTH MONITORING – OVERVIEW **9**

Structural Health – Factors affecting Health of Structures, Causes of Distress and Regular Maintenance – Structural Health Monitoring – Concepts, Various Measures and Structural Safety in Alteration.

UNIT II: STRUCTURAL AUDIT **9**

Assessment of Health of Structure – Collapse and Investigation – Investigation Management – SHM Procedures – Report preparation.

UNIT III: STATIC FIELD TESTING **9**

Types of Static Tests – Simulation and Loading Methods – Sensor systems and hardware requirements – Static Response Measurement – Optimal placement of sensors.

UNIT IV: DYNAMIC FIELD TESTING **9**

Types of Dynamic Field Test – Stress History Data – Dynamic Response Methods – Hardware for Remote Data Acquisition Systems – Remote Structural Health Monitoring.

UNIT V: ADVANCED CONCEPTS **9**

Case Studies /Site Visits – Piezo-electric material and other smart materials – electro-mechanical impedance (EMI) technique and adaptations.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Explain the fundamentals and need of health monitoring of structures.
- Conduct structural audit for health assessment of structures.
- Assess the health of structure using static field methods.
- Assess the health of structure using dynamic field tests.
- Apply EMI technique for health monitoring of structure.

TEXT BOOKS

1. Daniel Balageas, Claus Peter Fritzen and Alfredo Güemes,"Structural Health Monitoring", John Wiley and Sons, 5th Edition, 2017.
2. Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc, 3rd Edition, 2018.

REFERENCES

1. Douglas E Adams, "Health Monitoring of Structural Materials and Components Methods with Applications", John Wiley and Sons, 2nd Edition, 2016.
2. J. P. Ou, H. Li and Z.D.Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol 1, Taylor and Francis Group, London, 1st Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/114/106/114106046/ (Introduction to SHM)
2. https://nptel.ac.in/courses/112/104/112104160/ (SHM of Composites)

21PSP204 **FRACTURE MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Describe fracture mechanics principles.
- Understand the effect of scale in fracture mechanics.
- Exposed to numerical methods for analysis of concrete elements.
- Understand the importance of numerical modeling.
- Control steel fracture.

UNIT I: ESSENTIALS OF CONCRETE FRACTURE **9**

Introduction – Blunt crack band theory – Finite element implementation – Energy considerations – Applications and practical analysis – Crack development – General model for progressive fracturing.

UNIT II: SCALE EFFECTS **9**

Introduction – Dimensional analysis applied to plain and reinforced concrete structures – Fracture stability in plain and reinforced concrete elements – Hysteretic behavior of reinforced concrete elements.

UNIT III: NUMERICAL METHODS **9**

The behavior of concrete in a tension test – Comparison between concrete and steel – Tensile fracture zones – A general model for the tensile fracture of concrete – Material properties – FEM analysis of a fracture zone: coincident with predetermined crack path – FEM analysis of a fracture zone: not coincident with predetermined crack path.

UNIT IV: NUMERICAL MODELLING **9**

Discrete crack models for concrete – The linear model. – The nonlinear model – Crack propagation modeling: the future**.**

UNIT V: FRACTURE OF STEEL **9**

Fracture – Fracture under extreme conditions – Fatigue – Environment sensitive cracking.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply the fundamentals of fracture mechanics to concrete structures.
- Demonstrate scale effects in crack analysis of concrete elements.
- Use FEM concepts to analyze cracked concrete members.
- Model the pre cracked element numerically.
- Explain the fracture of steel.

TEXT BOOKS

1. David Broek, "The practical use of fracture mechanics", Kluwer Academic Publishers, 10th Edition, 2018.
2. Gdoutos.E.E, "Fracture Mechanics-An Introduction", Kluwer Academic publishers, 3rd Edition, 2020.

REFERENCES

1. George C. Sih, A. Ditomasso, "Fracture mechanics of concrete: Structural application and numerical calculation", 4th Edition, Springer Science & Business Media, 2016.
2. Anderson T.L, "Fracture mechanics: Fundamentals and Applications", CRC Press, 4th Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/112/106/112106065/ (Engineering Fracture Mechanics)
2. https://onlinecourses.nptel.ac.in/noc19_me42/preview (Introduction to Engineering Fracture Mechanics)

21PSP205 PRE–STRESSED CONCRETE STRUCTURES L T P C
3 0 0 3

(IS 1343: 1980, IS 784: 2001, IS 784: 1959 & IS 15916: 2010 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Get exposed to various systems of pre–stressing.
- Understand the design of flexural members for shear, bond and torsion and end blocks.
- Acquire knowledge on continuous beams and their design.
- Design the tension and compression members and the process of pre– stressing.
- Analyze and design pre–stressed concrete bridges.

UNIT I: PRINCIPLES OF PRESTRESSING 9

Principles of Pre-stressing – Types and systems of pre-stressing, Constituent materials and their properties – Analysis methods – Losses – Deflection (short & long term) – Camber and cable layouts.

UNIT II: DESIGN OF FLEXURAL MEMBERS 9

Behavior of flexural members – Determination of ultimate flexural strength – Codal provisions – Design of flexural members – Design for shear – Bond and torsion – Design of end blocks.

UNIT III: DESIGN OF CONTINUOUS BEAMS 9

Analysis and design of continuous beams – Methods of achieving continuity – Concept of linear transformations – Concordant cable profile and gap cables.

UNIT IV: DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of tension members – Application in the design of pre-stressed pipes and pre-stressed concrete cylindrical water tanks – Design of compression members with and without flexure – Application in the design of piles, flag masts and similar structures.

UNIT V: DESIGN OF PRESTRESSED CONCRETE BRIDGES 9

Composite Beams – Analysis and design – Pre-stressed deck Slab Bridge – Composite sections – Ultimate strength – Application in pre-stressed concrete bridges – Design of pre-tensioned and post tensioned girder bridges – Partial pre-stressing – Advantages and applications.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Analyze the pre-stressed concrete element using various methods.
- Design pre-stressed concrete flexural members.
- Design profiles for pre-stressed continuous beams.
- Design pre-stressed tension and compression members as per codal recommendations.
- Design pre-stressed concrete bridges as per IRC specifications.

TEXT BOOKS

1. Karuna Mho Ghosh, "Pre-stressed Concrete", PHI Learning Private Limited, 2nd Edition, 2018.
2. Rajagopalan.N, "Pre-stressed Concrete", Narosa Publications, 2nd Edition, 2017.

REFERENCES

1. Krishna Raju, "Pre-stressed Concrete", Tata McGraw-Hill Publishing Co, 6th Edition, 2018.
2. Muthu K.U and Azmi Ibrahim, "Pre-stressed Concrete", PHI Learning Private Limited, 1st Edition, 2011.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106118/ (Prestressing System)
2. https://www.digimat.in/nptel/courses/video/105106118/L05.html (Pre-Stressed Concrete Structures)

SEMESTER II

PROFESSIONAL ELECTIVE III

21PSP206 STRUCTURAL OPTIMIZATION L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce the fundamentals of optimization concepts and their applications in the structural engineering field.
- Study the linear programming methods of the optimization.
- Identify suitable non-linear programming methods for structural optimization.
- Understand the various methods of optimality involving geometric and dynamic programming.
- Have an exposure on the various advanced techniques for optimization in water distribution and plumbing.

UNIT I: OPTIMIZATION FUNDAMENTALS 9

Optimization methods – Introduction, Problem formulation, Introduction to mathematical principles in optimization – Mathematical models – Activity – Design methodology – Civil engineering case study – Unconstrained functions – Single variable – Several variable – Equality constraints – Inequality constraints – Optimization – Design space – Feasible and Infeasible – Convex and concave – Active constraints – Local and Global optima – Differential Calculus – Optimality criteria – Lagrange multiplier method – Kuhntucker Criteria.

UNIT II: LINEAR PROGRAMMING 9

Formulation of problems – Graphical solution – Analytical methods – Standard form – Slack, surplus and artificial variables – Canonical form – Basic feasible solution – Simplex method – Two phase method – Penalty method – Duality theory – Primal – Dual algorithm.

UNIT III: NON–LINEAR PROGRAMMING 9

Introduction to non-linear problems – One dimensional minimization methods – Uni-modal function – Exhaustive and unrestricted search – 116 Dichotomous search – Fibonacci method – Golden section method – Interpolation methods – Unconstrained multivariable function – Uni-variate method – Cauchy's steepest descent method – Conjugate gradient method (Fletcher Reeves) – Variable metric methods (Davison-Fletcher-Powell) – Direct and indirect methods – Interior Penalty function – External Penalty function method.

UNIT IV: GEOMETRIC PROGRAMMING AND DYNAMIC PROGRAMMING 9

Geometric Programming – Polynomial – Degree of difficulty – Reducing G.P.P. to a set of simultaneous equations – Concepts of solving problems with zero difficulty and one degree of difficulty – Dynamic Programming – Bellman's principle of optimality – Representation of a multi stage decision problem – Concept of sub - optimization problems – Truss optimization.

UNIT V: NON–TRADITIONAL METHODS **9**

Requirements of water distribution – Components – Service reservoirs – Functions and drawings – Network design – Economics – Computer applications – Analysis of distribution networks – Appurtenances – Operation and maintenance – Leak detection, Methods. Principles of design of water supply in buildings – House service connection – Fixtures and fittings – Systems of plumbing and drawings of types of plumbing.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply the basic ideas in optimization to make the structures as lightly as possible.
- Use linear programming techniques in engineering optimization.
- Evaluate the non-linear programming methods for structural optimization.
- Illustrate the methods adopted in solving the problems related to geometric and dynamic Programming.
- Apply advanced techniques of optimization for water distribution and plumbing.

TEXT BOOKS

1. Belegundu. A.D.and Chandrapatla,T.R.,"Optimisation Concepts and Applications in Engineering", Pearson Education, 3rd Edition, 2017.
2. Deb K., "Optimisation for Engineering Design", Algorithms and examples, Prentice Hall, 3rd Edition, 2016.

REFERENCE

1. Rao.S.S.,"Engineering Optimization: Theory and Practice", Wiley Publishers, 5th Edition, 2020.
2. Jasbir Arora , "Introduction to Optimum Design", Elsevier, 4th Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/112/101/112101298/ (Optimization from fundamentals)
2. https://nptel.ac.in/courses/111/105/111105039/ (Optimization – Introduction)

21PSP207	ENERGY EFFICIENT STRUCTURES	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Create awareness of the necessity of energy needed for structures.
- Study the different climate types and their influence in building design.
- Focus on the thermal environment of structures.
- Equip the knowledge of appliances and their utilization in buildings.
- Elucidate the energy audit systems in buildings.

UNIT I: INTRODUCTION **9**

Need of energy in buildings – Assessment – Energy consumption pattern of various types of buildings – Factors influencing the energy use in building – Concepts of energy efficient building.

UNIT II: CLIMATE **9**

Study of Climate types – their influence in building design – Environmental factors affecting building design – Analysis of thermal and visual environment.

UNIT III: HEAT AND LIGHT **9**

Heat gain and loss phenomenon in buildings – Thermal performance parameters – Role of building enclosures, openings and materials in thermal environment – Basic principles of light and daylight – Energy efficient light design of buildings – Daylight design of buildings.

UNIT IV: APPLIANCES IN BUILDINGS **9**

Major appliances in building and their energy consumptions – Principles of solar heating, cooling and power (PV) systems – Integration of energy efficient appliances with the buildings**.**

UNIT V: ENERGY AUDIT **9**

Energy survey and energy audit of buildings – Calculation of energy inputs and utilization in buildings – Energy audit reports of buildings – Concepts of Green Buildings – Energy rating of buildings.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Assess various energy consumption patterns.
- Analyze the climate and environmental factors affecting building design.
- Design of buildings according to thermal Environment.
- Integrate energy efficient appliances with buildings.
- Perform energy audit in buildings.

TEXT BOOKS

1. Francesco Asdrubali, "Handbook of Energy Efficiency in Buildings", Elsevier, 1st Edition, 209+3.
2. Threlkeld, J.L., "Thermal Environmental Engineering", Prentice–Hall, 3rd Edition, 2016.

REFERENCE

1. Lal Jayamaha, "Energy–Efficient Building Systems: Green Strategies for Operation and Maintenance", McGraw Hill, 6th Edition, 2016.
2. Krishnan, A., Baker, N., Yannas, S. and Szokolay, S.V., "Climate Responsive Architecture – A Design Hand Book for Energy Efficient Buildings", Tata McGraw Hill Publishing Company Ltd, 5th Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/102/105102175/ (Energy Efficiency, Acoustics and day lighting in building)
2. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18–me44/ (Energy conservation and waste heat recovery)

21PSP208	WIND AND CYCLONE EFFECTS ON STRUCTURES (IS 875:1987 PART I & III are to be permitted)	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Identify the types and characteristics of wind loads on structures.
- Understand wind tunnel studies to model wind experimentally.
- Study the effect of wind on structures.
- Use codal provisions for design structures subjected to wind.
- Get exposed to the behavior of cyclone on buildings

UNIT I: WIND LOADING ON STRUCTURES **9**

Introduction, Types of wind – Characteristics of wind – Wind velocity, Method of measurement – Variation of speed with height, shape factor, aspect ratio and drag effects – Dynamic nature of wind – Pressure and suctions – Spectral studies, Gust factor.

UNIT II: WIND TUNNEL STUDIES **9**

Wind Tunnel Studies, Types of tunnels – Prediction of acceleration – Load combination factors – Wind tunnel data analysis – Calculation of Period and damping value for wind design – Modeling requirements, Aero dynamicand Aero-elastic models.

UNIT III: EFFECT OF WIND ON STRUCTURES **9**

Classification of structures – Rigid and Flexible – Effect of wind on structures – Static and dynamic effects on tall buildings – Chimneys.

UNIT IV: DESIGN OF SPECIAL STRUCTURES **9**

Design of Structures for wind loading as per IS/ASCE, BS and NBC provisions – design of Tall Buildings – Chimneys –Transmission towers and steel monopoles – Industrial sheds.

UNIT V: CYCLONE EFFECTS **9**

Types – Cyclone effect on low rise structures – Sloped roof structures – Tall buildings – Effect of cyclone on claddings – Design of cladding – Use of code provisions in cladding design – Analytical procedure and modeling of cladding – Codal provisions.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply the knowledge of wind loadings to design structures.
- Perform wind tunnel studies to model wind experimentally.
- Predict the effect of wind on structures.
- Design tall structures subjected to wind as per codal provisions.
- Analyze the behavior of cyclone on buildings.

TEXT BOOKS

1. Emil Simiu and Dong Hun Yeo, "Wind Effects on Structures", Wiley Publishers, 1st Edition, 2016.
2. Peter Sachs, "Wind Forces in Engineering", Pergamon Press, 2nd Edition, 2016.

REFERENCE

1. Cook.N.J., "The Designer's Guide to Wind Loading of Building Structures", Butterworth's, 1st Edition, 2016.
2. John D Holmes, "Wind loading of structures" Taylor and Francis group, 4th Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/102/105102016/ (Seismic analysis of structures)
2. https://nptel.ac.in/content/storage2/courses/101106040/chapter%201.pdf (Wind Tunnel)

21PSP209 **COMPUTER AIDED DESIGN OF STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the basics of graphic primitives, transformations and 2–D drafting of computer graphics.
- Get practiced with computer methods of structural analysis.
- Understand the structural design concepts.
- Perform linear programming and CPM and PERT.
- Inculcate the students with Artificial Intelligence.

UNIT I: COMPUTER GRAPHICS **9**

Graphic primitives – Transformations – Basics of 2-D drafting – Modeling of curves and surfaces – Wire frame modeling – Solid modeling – Graphic standards – Drafting software packages and usage.

UNIT II: STRUCTURAL ANALYSIS **9**

Computer aided analysis of steel and RC Structural elements – Application of software**.**

UNIT III: STRUCTURAL DESIGN **9**

Computer aided design of steel and RC Structural elements – Detailed drawing – Bill of materials.

UNIT IV: OPTIMIZATION **9**

Application of linear programming – Simplex algorithm – Post–optimality analysis – Project scheduling – CPM and PERT applications.

UNIT V: ARTIFICIAL INTELLIGENCE **9**

Introduction – Heuristic search – knowledge based expert systems – Rules and decision tables – Inference mechanisms– Simple applications – Genetic algorithm and applications – Principles of Neural network – Architecture and applications of KBES – Expert system shells.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Draft 2 D drawings using drafting software.
- Perform structural analysis using analysis package.
- Design the structures with computer methodologies.
- Optimize the structural design with various computer packages and graphics.
- Apply artificial intelligence to real life applications.

TEXT BOOKS

1. Rao. S.S., "Engineering Optimization", Wiley Publishers, 5th Edition, 2019.
2. Groover M.P. and Zimmers E.W.Jr.," CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, 1st Edition, 2016.

REFERENCE

1. Krishnamoorthy C.S and Rajeev S, "Computer Aided Design", Narosa Publishing House, 2nd Edition, 2018.
2. Srinivasa Prakash Regalla, "Computer Aided Analysis and Design", I.K. International Publishing House Pvt. Limited, 3rd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/106/106/106106090/ (Computer Graphics)
2. https://nptel.ac.in/courses/106/102/106102220/ (An introduction to Artificial Intelligence)

21PSP210 MECHANICS OF COMPOSITE MATERIALS L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the composite materials and properties of composite fiber and matrix constituents.
- Idealize stress strain relation of orthotropic and anisotropic materials.
- Carryout the static, dynamic and stability analysis for simpler cases of composite plates.
- Elucidate the failure criterion and fracture mechanism of composites.
- Use the metal and ceramic composite & design with composites.

UNIT I: NTRODUCTION TO COMPOSITES **9**

Introduction to Composites – Classifying composite materials and their properties – Commonly used fiber and matrix constituents – Composite Construction – Properties of Unidirectional Long Fiber Composites – Short Fiber Composites.

UNIT II: STRESS STRAIN RELATIONS **9**

Concepts in solid mechanics – Hooke's law for orthotropic and anisotropic materials – Linear Elasticity for Anisotropic materials – Rotations of stresses, strains, residual stresses.

UNIT III: ANALYSIS OF LAMINATED COMPOSITES **9**

Governing equations for an isotropic and orthotropic plate – Angle-ply and cross ply laminates - Static, dynamic and stability analysis for simpler cases of composite plates – Inter laminar stresses.

UNIT IV: FAILURE AND FRACTURE OF COMPOSITES **9**

Netting analysis – Failure criterion – Maximum stress - Maximum strain – Fracture mechanics of composites – Sandwich construction.

UNIT V: APPLICATIONS AND DESIGN **9**

Metal and ceramic matrix composites – Applications of composites – Composite joints – Design with composites – Environmental issues.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Identify the fiber types and classify the composite material.
- Relate the stress – strain properties, longitudinal and transverse properties of composites lamina.
- Analyze the laminated composites and compute the lamina strength.
- Find the failure criterion and fracture mechanics of composites.
- Apply the load deformation relation, residual stresses for the design of composites.

TEXT BOOKS

1. Agarwal. B.D and Broutman.L.J, "Analysis and Performance of fiber composites", John-Wiley and Sons, 4th Edition, 2017.
2. Michael W.Hyer, "Stress Analysis of Fiber-Reinforced Composite Materials", McGraw Hill, 10th Edition, 2016.

REFERENCE

1. Ronald F. Gibson, "Principles of Composite Material Mechanics", CRC Press, 4th Edition, 2016.
2. Krishan K. Chawla, "Composite Materials Science and Engineering", Springer, 2nd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/112/104/112104229/ (Introduction to composites)
2. https://nptel.ac.in/courses/105/108/105108124/ (Composite Materials)

SEMESTER III

PROFESSIONAL ELECTIVE–IV

21PSP301 DESIGN OF OFFSHORE STRUCTURES L T P C
3 1 0 4

(IS 4561 Part 1, 2, 3, 4 & 5, IS 9527 Part 1, 3 & 4, IS 10020 Part 4: 1981 & SP 64 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Understand the principles of wave theory.
- Identify the various forces acting on offshore structures.
- Introduce the concepts of modeling of offshore structures.
- Get exposed to analyse methods offshore structures.
- Design structures like platform, helipads, jacket towers.

UNIT I: WAVE THEORIES 9+3

Wave generation process, small, finite amplitude and nonlinear wave theories.

UNIT II: FORCES OF OFFSHORE STRUCTURES 9+3

Wind forces, wave forces on small bodies and large bodies – Current forces – Morison equation.

UNIT III: OFFSHORE STRUCTURE MODELLING 9+3

Different types of offshore structures, foundation modeling, fixed jacket platform structural modeling.

UNIT IV: ANALYSIS OF OFFSHORE STRUCTURES 9+3

Static method of analysis – foundation analysis and dynamics of off shore structures.

UNIT V: DESIGN OF OFFSHORE STRUCTURES 9+3

Design of platforms – Helipads, Jacket tower – Analysis and design of mooring cables and pipelines – Wind turbines.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply principles of wave theory.
- Evaluate forces on offshore structures.
- Perform modeling of soil and offshore structures.
- Analyze offshore structures.
- Design structures like platform, helipads, jackets, towers.

TEXT BOOKS

1. Mohamed A El-Reedy, "Offshore Structures Design, Construction and Maintenance", Elsevier Science, 2nd Edition, 2019.
2. Chakrabarti Subrata, "Handbook of Offshore Engineering", Elsevier Science, 1st Edition, 2017.

REFERENCES

1. Reddy.D.V and Swamidas A.S.J, Essentials of Offshore Structures, CRC Press, 2nd Edition, 2016.
2. Yong Bai, Wei-Liang Jin, "Marine Structural Design", Elsevier Science, 2nd Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/114/106/114106011/ (Design of Offshore structures)
2. https://nptel.ac.in/courses/114/106/114106015/ (Foundation of Offshore structures)

21PSP302 DESIGN OF STEEL CONCRETE COMPOSITE STRUCTURES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Introduce the composite construction and composite behaviour of steel concrete composite structures.
- Obtain the knowledge to conceptualize and design the composite beams, columns, floors, slabs and concrete filled steel tubes.
- Design composite floors and to analyze internal forces and moments.
- Design composite columns under compression and bending.
- Understand the design considerations for composite trusses.

UNIT I: THEORY OF COMPOSITE STRUCTURES 9+3

Introduction to Steel-Concrete Composite Construction – Merits and demerits – Theory of composite structures – Introduction to IS and Euro codal provisions for steel concrete composites design – Local buckling and section classification – Limit states – Partial safety factors – Introduction to Steel - Concrete - Steel - Sandwich Construction.

UNIT II: COMPOSITE BEAMS 9+3

Introduction to composite beams – Advantages – Elastic behavior of composite beams – No interaction and Full interaction – Shear connectors – Types and load bearing mechanism of shear connectors – Ultimate load behavior of composite beam – Serviceability limit states – Types, merits and behavior of profiled decking – Propped and un-propped conditions – Basic design considerations – Design of simply supported and continuous composite beam (with or without profile deck).

UNIT III: COMPOSITE FLOORS 9+3

Introduction to composite floors – Benefits – Sheeting parallel to span – Sheeting perpendicular to span – Ponding effect – Structural elements – Bending resistance – Shear resistance – Serviceability criteria – Analysis of internal forces and moments – Design of Composite floors.

UNIT IV: COMPOSITE COLUMNS 9+3

Introduction to composite columns and its types – Advantages – Materials – Proposed design method – Design parameters and checks for structural adequacy – Resistance of encased composite column cross section and in filled composite column cross section under compression – Effective elastic flexural stiffness – Design of both encased and in filled composite column under axial compression, uniaxial bending and biaxial bending.

UNIT V: COMPOSITE TRUSSES **9+3**

Introduction – Loads and analysis of trusses – Configuration of trusses – Behaviour and application of composite truss – Truss members – Composite connections – Design consideration – Stud specifications – Design of composite truss – Case studies on steel-concrete composite construction in buildings.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the basic concepts of steel concrete composite construction.
- Analyze and design composite beams with or without profile decking sheet.
- Design composite floors with the provision of profile decking sheet.
- Design the encased and in–filled composite columns.
- Illustrate the design of composite trusses and case studies.

TEXT BOOKS

1. Johnson R.P., "Composite Structures of Steel and Concrete", Blackwell Publishing, 8th Edition, 2019
2. David Collings, "Steel-concrete Composite Buildings", Thomas Telford, 4th Edition, 2017.

REFERENCES

1. Narayanan R, "Steel - Concrete Composite Structures', CRC Press, 1st Edition, 2019.
2. J.Y. Richard Liew, Ming–Xiang Xiong, Bing–Lin Lai, "Design of Steel–Concrete Composite Structures Using High–Strength Materials", Elsevier Science, 1st Edition, 2021.

E–RESOURCES

1. https://nptel.ac.in/courses/105/108/105108124/ (Composite materials)
2. https://nptel.ac.in/courses/105/105/105105162/ (Design of steel structures)

21PSP303 **DESIGN OF MASONRY STRUCTURES** **L T P C**
3 1 0 4

(IS 1905: 1987, IS 13827: 1993 & IS 13828: 1993 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Describe the basic principles of design of masonry elements.
- Understand the structural interactions between wall – columns.
- Use codal provisions to arrive strength of masonry.
- Introduce the concepts of pre-stressed masonry.
- Apply elastic and inelastic analysis methods to predict masonry behaviour under failure.

UNIT I: INTRODUCTION **9+3**

Historical Perspective – Masonry Materials - Masonry Design Approaches – Overview of Load Conditions – Compression Behavior of Masonry – Masonry Wall Configurations – Distribution of Lateral Forces.

UNIT II: INTERACTIONS **9+3**

Structural Wall – Columns and Pilasters – Retaining Wall – Pier and Foundation.

UNIT III: STRENGTH **9+3**

Flexural strength of reinforced masonry members – In plane and out-of-plane loading – Shear strength and ductility of reinforced masonry members.

UNIT IV: PRESTRESSED MASONRY **9+3**

Stability of walls – Coupling of masonry walls, openings, columns and beams.

UNIT V: ELASTIC AND INELASTIC ANALYSIS **9+3**

Modeling Techniques – Static Push over Analysis and use of Capacity Design Spectra.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply the masonry design approaches.
- Analyze the interactions of reinforced masonry members.
- Determine shear strength and ductility of Reinforced Masonry members.
- Use the concept of prestressed masonry in fields.
- Check the stability of walls and Perform elastic and inelastic analysis of masonry walls.

TEXT BOOKS

1. A.W. henry, Sinha and S.R.Davies, "Design of masonry structures", Taylor and francis, 4th Edition, 2017.
2. Narendra Taly, "Design of reinforced masonry structures", The McGraw Hill, 5th Edition, 2016.

REFERENCES

1. R.S. Schneider and W.L. Dickey, "Reinforced Masonry Design", Prentice Hall, 4th Edition, 2016.
2. Drysdale, R. G. Hamid, A. H. and Baker, L. R, "Masonry Structures: Behaviour & Design", Prentice Hall Hendry, 1st Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106197/ (Design of masonry structures)
2. https://www.digimat.in/nptel/courses/video/105106197/L01.html (Design of masonry structures)

21PSP304 **NON-LINEAR ANALYSIS** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Study the concept of non–linear behavior of beams and vibrations of beams.
- Perform the elastic analysis of statically determinate and indeterminate flexural members.
- Apply the governing equation for static and dynamic analysis of composite plate.
- Carryout the inelastic analysis of statically determinate and indeterminate flexural members.
- Study the non–linear analysis of plates and its governing equation.

UNIT I: NON LINEAR BENDING AND VIBRATION OF BEAMS **9+3**

Introduction –Types of non-linearity – Non-linear governing equation for beams – Geometrically non-linear beam problems – Vibrations of beams with various boundary conditions – Forced vibration of beams – Post buckling cantilever column – Behavior of beams with material non-linearity – Non-linear vibration and instabilities of elastically supported beams.

UNIT II: ELASTIC ANALYSIS OF FLEXURAL MEMBERS **9+3**

Flexural behavior – Statically determinate and statically – Indeterminate bars – Uniform and varying thickness.

UNIT III: ANALYSIS OF LAMINATED COMPOSITES **9+3**

Governing equations for an isotropic and orthotropic plate – Angle-ply and cross ply laminates – Static, dynamic and stability analysis for simpler cases of composite plates – Inter laminar stresses.

UNIT IV: IN ELASTIC ANALYSIS OF FLEXURAL MEMBERS **9+3**

Inelastic analysis of uniform and variable thickness members subjected to small deformations – Inelastic analysis of flexible bars of uniform and variable stiffness – Members with and without axial restraints.

UNIT V: NON LINEAR STATIC AND DYNAMIC ANALYSIS OF PLATES **9+3**

Introduction – Governing non-linear equations for plates – Boundary conditions and methods of solutions – Large deflection analysis of rectangular and non-rectangular plates – Free and forced vibrations of rectangular and nonrectangular plates – Post buckling behaviour of plates – Effects of transverse shear deformations and material nonlinearity.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Analyze the beam using basic concept of non–linearity and vibration.
- Analyze statically determinate and indeterminate flexural members.
- Analyze the composite plates for static and dynamic condition.
- Understand the inelastic analysis with various boundary conditions of thin walled structural members.
- Perform static and dynamic analysis of plates.

TEXT BOOKS

1. Sathyamoorthy. M, "Non-linear Analysis of Structures", CRC Press, 3rd Edition, 2017.
2. Fertis. D. G.,"Non-linear Mechanics", CRC Press, 2nd Edition, 2016.

REFERENCES

1. Reddy.J.N, "Non-linear Finite Element Analysis", Oxford University Press, 4th Edition, 2018.
2. Gang Li, Kevin Wong, "Theory of Nonlinear Structural Analysis", Wiley Publishers, 2nd Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/108/106/108106162/ (Non–Linear Analysis System)
2. https://nptel.ac.in/courses/112/104/112104161/ (Mechanics of Laminated Composite Strucutres)

21PSP305 **BRIDGE STRUCTURES** **L T P C**
3 1 0 4

(IS 456:2000, IS 458: 1971, IRC 5: 1998, IRC 6: 2001, IRC 18: 2000, IRC 21: 2000, IRC 22: 1986, IRC 24: 2001, IRC 78: 2000,IRC 83 Part 1 & 2 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Develop skills of students in designing various types of bridges.
- Design the short span bridges.
- Design the long span bridges.
- Design the pre-stressed bridges.
- Design the bearings & concrete piers.

UNIT I: INTRODUCTION **9+3**

Classification, investigations and planning, choice of type, I.R.C. specifications for road bridges, standard live loads, other forces acting on bridges & general design considerations.

UNIT II: SHORT SPAN BRIDGES **9+3**

Introduction – Design of culvert – Deck Slab Bridge – Load distribution theories – Pigeaud's Theory – T-beam and girder bridges.

UNIT III: LONG SPAN GIRDER BRIDGES **9+3**

Introduction – Procedure & Design principles of continuous bridges – Box girder bridges – Balanced cantilever bridges

UNIT IV: DESIGN OF PRESTRESSED BRIDGES **9+3**

Flexural and Torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – Maximum and minimum pre-stressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – Check for stresses at various sections – Check for diagonal tension – Diaphragms – End block – Short term and long term deflections.

UNIT V: DESIGN OF BEARINGS AND SUBSTRUCTURES **9+3**

Different types of bearings – Design of bearings – Design of masonry and concrete piers and abutments – Types of bridge foundations – Design of foundations.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the design theories for super structure and sub structure of bridges.
- Design short span bridges.
- Understand the behaviors continuous bridges, box girder bridges.
- Design pre-stressed concrete bridges.
- Identify the Different types of bearings, abutments, piers and types of foundations for Bridges.

TEXT BOOKS

1. Krishna Raju.N "Design of Bridges", Oxford and IBH Publishing Company, 4th Edition, 2017.
2. T.R. Jagadeesh and M.A. Jayaram, "Design of Bridge Structures", Prentice Hall of India Pvt.Ltd, 2nd Edition 2018.

REFERENCES

1. Ponnuswamy S, "Bridge Engineering", Tata McGraw Hill, 2nd Edition, 2017.
2. D. Johnson Victor, "Essentials of Bridge Engineering", Oxford and IBH Publishing Co, 6th Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/105/105/105105165/ (Reinforced Concrete Road Bridge)
2. http://www.digimat.in/nptel/courses/video/105105165/L18.html (Reinforced Concrete Road Bridge)

SEMESTER III

PROFESSIONAL ELECTIVE–V

21PSP306	**DESIGN OF STRUCTURES FOR DYNAMIC LOAD**	**L T P C** **3 1 0 4**

OBJECTIVES

The main objective of this course is to:

- Study the behavior of R.C.C. under the action of impact and cyclic loads.
- Study the characteristics of seismic loading and to design structures subjected to seismic loads.
- Understand the effects of blast loads on structure for analysis and design.
- Study the effect of wind of loading on structures, their analysis and design.
- Understand the response of dams, bridges and buildings against different disasters.

UNIT I: GENERAL **9+3**

Design philosophy to resist earthquake, cyclone, flood, blast and impact – National and International codes of practice – Behavior of concrete, steel, masonry and soil under impact and cyclic loads – Energy absorption capacity – Ductility of material and the structure – Design Against Cyclone And Flood: Effect of cyclones on buildings and special structures – Safety and precautionary steps in design.

UNIT II: DESIGN AGAINST EARTHQUAKES **9+3**

Earthquake characterization – Response spectrum – seismic coefficient and response spectra methods of estimating loads – Response of framed, braced frames and shear wall buildings – Design as per BIS codes practice – Ductility based design.

UNIT III: DESIGN AGAINST BLAST AND IMPACT **9+3**

Characteristics of internal and external blast – Impact and impulse loads – Explosions – Threats – wave scaling law – Fire loading – Restraints – Pressure distribution on buildings above ground due to external blast – Underground explosion – Design of buildings for blast , fire and impact as per BIS code of practice.

UNIT IV: DESIGN AGAINST WIND **9+3**

Characteristics of wind – Basic and design wind speeds Aero-elastic and Aerodynamic effect – Design as per BIS code of practice including Gust factor approach – Along wind and across wind response– effect on tall buildings, towers, chimneys, roofs, window glass, Cladding and slender structures – vibration of cable supported bridges and power lines due to wind effects – tornado effects.

UNIT V: SPECIAL CONSIDERATIONS **9+3**

Detailing for ductility – Passive and active control of vibrations – New and favorable materials – Response of dams, bridges, buildings – Strengthening measures – Safety analysis – Methods of strengthening for different disasters – Maintenance and modifications to improve hazard resistance.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the effects of dynamic loads like earthquake, blast and impact on structures.
- Describe the concepts of seismic resistant design as per BIS code.
- Design the structures against blast and impact loads.
- Calculate effect of wind on structures and design against wind load.
- Understand the knowledge on the concepts of favorable materials for ductility based designing of structure along with strengthening methods.

TEXT BOOKS

1. Daniel J Inman, "Vibration with Control", Wiley Publishers, 2nd Edition, 2018.
2. Bela Goschy, "Design of Buildings to withstand abnormal loading", Butterworhts, 1st Edition, 2017.

REFERENCES

1. Paulay.T and Priestly. M.N.J, "A seismic Design of Reinforced Concrete and Masonry Buildings", John Wiley and Sons, 2nd Edition, 2016.
2. Dowling C.H, "Blast Vibration – Monitoring and Control", Prentice Hall Inc, 1st Edition, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106151/ (Structural Dynamics)
2. https://nptel.ac.in/courses/105/101/105101006/ (Structural Dynamics)

21PSP307 DESIGN OF SHELL AND SPATIAL STRUCTURES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Classify and analyze the different type of shell structures.
- Design circular domes, conical roofs and circular cylindrical shells.
- Study the behavior of pyramidal roof.
- Use the general design philosophy for designing space frames.
- Study the finite element analysis shell structures.

UNIT I: SHELL CLASSIFICATION AND ANALYSIS 9+3

Classification of shells – Structural actions – Membrane theory – Analysis of spherical domes – Cylindrical shells – Folded plates.

UNIT II: DESIGN OF SHELLS 9+3

Design of circular domes – Conical roofs – Circular cylindrical shells.

UNIT III: FOLDED PLATES 9+3

Folded plate structures – Structural behavior – Types – Design – Pyramidal roof.

UNIT IV: INTRODUCTION TO SPACE FRAME 9+3

Space frames – Configuration – Types of nodes – General principles of design Philosophy – Behavior.

UNIT V: FINITE ELEMENT ANALYSIS 9+3

Finite element application on cylindrical shells – Introduction to shell elements – Flat elements – Axisymmetric elements – Degenerated elements – General shell elements.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Analyze and design various shell and spatial structures.
- Design different types of domes.
- Classify and interpret the behavior of folded plates.
- Evaluate the structural behavior and philosophy of space frames.
- Design shell elements using finite element analysis.

TEXT BOOKS

1. Billington.D.P, "Thin Shell Concrete Structures", McGraw Hill Book Co, 6th Edition, 2017.
2. Avelino Samartin Quiroga, Edgard Backx, "Shell and Spatial Structures: Computational Aspects", Springer, 2nd Edition, 2016.

REFERENCES

1. Subramanian.N ,"Principles of Space Structures", Wheeler Publishing Co, 4th Edition, 2017.
2. Ramasamy. G.S., "Design and Construction of Concrete Shells Roofs", CBS Publishers, 1st Edition, 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/124/105/124105015/ (Shell structures)
2. https://nptel.ac.in/courses/105/103/105103209/ (Plates and Shells)

21PSP308 **DESIGN OF SUB–STRUCTURES** **L T P C**
3 1 0 4

(IS 1904: 1986, IS 6403: 1981, IS 8009: 1976, IS 456: 2000, IS 2911 Part 1 to 4: 2010, IS 2974: 1992 Part 1– 5 are to be permitted)

OBJECTIVES

The main objective of this course is to:

- Identify the different types of shallow foundation.
- Design pile caps and under-reamed pile foundations.
- Understand the concepts in designing well foundations.
- Apply basic principles of design of machine foundation.
- Adapt special foundation for concrete chimneys and towers.

UNIT I: SHALLOW FOUNDATIONS **9+3**

Soil investigation – Basic requirements of foundation – Types and selection of foundations. Bearing capacity of soil – Plate load test – Design of reinforced concrete isolated, strip, combined and strap footings – Mat foundation.

UNIT II: PILE FOUNDATIONS **9+3**

Introduction – Types of pile foundations – Load carrying capacity – Pile load test – Pile driving and construction – Configuration of piles – Different shapes of piles cap – Structural design of pile cap – Under-reamed pile foundation – Piles subjected to lateral loads – Combined raft foundation.

UNIT III: WELL FOUNDATIONS **9+3**

Types of well foundation – Grip length – Load carrying capacity – Construction of wells – Design aspects – Failures and Remedies – Design principles of well foundation – Lateral stability.

UNIT IV: MACHINE FOUNDATIONS **9+3**

Introduction – Types of machine foundation – Basic principles of design of machine foundation – Dynamic properties of soil – Vibration analysis of machine foundation – Design of foundation for Reciprocating machines and Impact machines – Construction aspects–vibration isolation.

UNIT V: SPECIAL FOUNDATIONS **9+3**

Foundation on expansive soils – Choice of foundation – Foundation for concrete Towers and chimneys – Reinforced earth retaining walls – Marine Foundations.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Select appropriate foundation type based on available soil conditions.
- Determine the load carrying capacity of pile foundation.
- Design the well foundations for construction engineering structures.
- Design the foundation for Reciprocating machines and Impact machines.
- Analyze the soil foundation on expansive soils and to design foundation for special structures

TEXT BOOKS

1. Varghese.P.C, "Design of Reinforced Concrete Foundations ǁ", PHI learning private limited, New Delhi, 1st Edition, 2018.
2. Michael J Tomlinson, John C Woodward, "Pile Design and Construction Practice", 6th Edition, CRC Press, 2018.

REFERENCES

1. Swamy Saran, "Analysis and Design of substructures ǁ", Oxford and IBH Publishing Co. Pvt. Ltd, 1st Edition, 2018.
2. Tomlinson.M.J, "Foundation Design and Construction ǁ", Longman, 6th Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/101/105101083/ (Foundation Engineering)
2. https://nptel.ac.in/courses/105/101/105101005/ (Soil Dynamics)

21PSP309 STRUCTURAL ANALYSIS BY MATRIX METHODS L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Introduce fundamental characteristics of elements and system by evaluation of its flexibility and stiffness matrices.
- Impart knowledge about analysis of system through direct and element approach of flexibility method.
- Analysis of structures by direct and element approach of stiffness method is to be included.
- Programming techniques for simple problems and use of standard programmes to be practiced.
- Use advanced techniques of matrix methods.

UNIT I: ENERGY CONCEPTS IN STRUCTURES 9+3

Introduction – Strain Energy – Symmetry of the Stiffness and Flexibility Matrices – Strain Energy in terms of Stiffness and Flexibility Matrices – Stiffness and Flexibility Coefficients in terms of Strain Energy – Additional properties of [a] and [k] – another Interpretation of coefficients a_{ij} and k_{ij} – Betti's law – Applications of Betti's law – Forces not at the coordinates – Strain energy in systems and in elements.

UNIT II: FLEXIBILITY METHOD 9+3

Direct method applied to beams and frames – Relationship between element and system – Strain Energy in terms of flexibility coefficients – Approach to equivalent joint load concept through Betti's Law – Problems in beams, frames, trusses including effect of temperature and support sinking.

UNIT III: STIFFNESS METHOD 9+3

Direct stiffness method to beams, frames and simple trusses – Strain energy in terms of stiffness coefficients – Relationship between element and systems – Static condensation techniques – Problems in beams, frames including secondary effects – Analysis of 3D structures – Grid and pin jointed trusses.

UNIT IV: PROGRAMMING 9+3

Programming of solution techniques for simultaneous equation solution – Matrix operation – Simple program development for element stiffness matrix – Assemblage – Complete structure of a stiffness analysis program with subroutines – Use of GTSTRUDL / STAAD / SAP to solve problems in trusses, beams and frames.

UNIT V: ADVANCED TOPICS 9+3

Sub structuring techniques – Force and displacements – Band width reduction – Tri-diagnolisation technique – Band solvers – Frontal solvers – Re analysis technique – Transfer matrix method – Use of symmetry and anti symmetry.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply strain energy concepts in structures.
- Apply the matrix flexibility method for planar trusses, beams, and frames.
- Analyze the direct stiffness method for three dimensional framed structures.
- Develope program for element stiffness matrix.
- Perform complex analysis procedures such as sub structuring and tri-diagonalization techniques.

TEXT BOOKS

1. William McGuire, Richard H. Gallagher, Ronald D. Ziemian, “Matrix structural Analysis”, Wiley, 1st Edition, 2018.
2. Natarajan C and Revathi P.,“Matrix Methods of Structural Analysis ll”, PHI Learning Private Limited, 1st Edition, 2016.

REFERENCES

1. Devdas Menon., “Advanced Structural Analysis ll”, Narosa Publishing House, 1st Edition, 2019.
2. Jack. C, Mc Cormac, “Structural Analysis: Using Classical and Matrix Methods", John Wiley, 4th Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/105/105105180/ (Matrix Method of Structural Analysis)
2. http://www.digimat.in/nptel/courses/video/105105180/L05.html (Matrix Method of Structural Analysis)

21PSP310 **COLD FORMED STEEL STRUCTURES** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand various cold formed steel structural elements.
- Introduce the thin elements in the design of cold formed steel.
- Design the web of beams, wide beam and short span beams.
- Design the flexural column buckling and wall studs.
- Design the light gauge steel shear diaphragms and shell roof structures.

UNIT I: INTRODUCTION **9+3**

General – Types of Cold Formed Steel Sections and their applications – Methods of Forming – Materials used in Cold Formed Steel Construction – Yield Point – Tensile Strength – Stress Strain Curve – Modulus of Elasticity and Tangent Modulus – Ductility – Weldability – Fatigue Strength and Toughness. Connections – Types of Connections – Welded Connections – Bolted Connections – Other Fasteners.

UNIT II: STRENGTH OF THIN ELEMENTS AND DESIGN CRITERIA **9+3**

General – Definitions of General Terms – Basic Design Stress – Wind, Earthquake and Combined forces – Structural Behavior of Compression Elements and Design Criteria – Stiffeners for Compression Elements – Structural Behavior of Perforated Elements – Plate buckling of Columns – Behavior of Webs of Beams and Cylindrical Tubular Elements.

UNIT III: DESIGN OF FLEXURAL MEMBERS **9+3**

General – Beam Strength and Deflection – Design of Webs of beams – Lateral Buckling of Beams – Bracing Requirements of Beams – Unusually Wide Beam Flanges and Unusually Short Span beams.

UNIT IV: DESIGN OF COMPRESSION MEMBERS **9+3**

General – Yielding – Flexural Column Buckling – Effect of Cold Work on Column Buckling – Effect of Local Buckling on Column Strength – AISI Design Formula for Flexural Buckling – Effective Length factor K – Torsional Buckling and Torsional–Flexural Buckling – Bracing and Secondary Members – Maximum Slenderness Ratio – Wall Studs – Testing of Wall Material for Lateral Bracing Value.

UNIT V: DESIGN OF BEAM COLUMNS **9+3**

General – Doubly symmetric shapes and shapes not subjected to torsional or torsional – Flexural buckling – Thin walled open Sections which may be subjected to Torsional-Flexural Buckling – Singly Symmetric Open Shapes – Unsymmetric Shapes – Light Gauge Steel Shear Diaphragms and shell Roof Structures – Light Gauge Steel Shear Diaphragms – Columns and Beams braced by Steel Diaphragms – Shell Roof Structures.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the concepts on the behavior of Cold formed steel structure.
- Apply the knowledge of thin elements in the design of cold formed steel.
- Design the cold formed steel flexural members as per codal provisions.
- Design the compression members as per codal provisions.
- Design the cold formed steel beam columns as per codal provisions.

TEXT BOOKS

1. Wie–Wen Yu, "Cold Formed Steel Structures", McGraw Hill Book Company, 3rd Edition, 2019.
2. Horne M.R. and Morris L.J., "Plastic Design of Low Rise Frames", Granada Publishing Ltd, 1st Edition, 2019.

REFERENCES

1. Salmon C.G. and Johnson J.E., "Steel Structures-Design and Behaviour", Harper and Row, 2nd Edition, 2019.
2. Dayaratnam P. "Design of Steel Structures", A.H. Wheeler, 4th Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106113/ (Design of Steel Structures II)
2. https://nptel.ac.in/courses/105/105/105105162/ (Design of Steel Structures)

SEMESTER III

PROFESSIONAL ELECTIVE–VI

21PSP311	THEORY OF PLATES	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce various plate theories, governing equations for bending of plates and various boundary conditions.
- Conceptualize Navier's solution and Levy's solution to analyze rectangular plates.
- Study the bending of circular plates.
- Understand the concepts of finite difference method.
- Study engineering design approach to plates.

UNIT I: INTRODUCTION TO PLATE THEORY **9**

Thin and thick plates – Small and large – Deflection theory of thin plate – Assumptions – Moment curvature relations – Stress resultants – Governing differential equation for bending of plates – Various boundary conditions.

UNIT II: RECTANGULAR PLATES **9**

Classical solution for rectangular plates with different types of loads and boundary conditions – Navier's and Levy's solution methods – Continuous plates (introduction only).

UNIT III: CIRCULAR PLATES **9**

Bending of circular plates with clamped and simply supported edges – Plate with central hole – Uniformly distributed and varying loads – Conical loads, Distributed couples – Ring loads – Semicircular plates – Asymmetrically loaded plates.

UNIT IV: FINITE DIFFERENCE METHOD **9**

Finite Difference Methods – Improved finite difference Methods – Energy Methods – Variational Methods – Galerkin's Methods – Matrix displacement Methods – Lattice analogy – Finite Element Method (Introduction only) – Application to plates.

UNIT V: ADVANCED TOPICS **9**

Large-Deflection Theory – Influence surface for plates – Skew plates – Orthotropic plate bending theory and bending of thick plates – Mindlin's Theory – Layered plates Engineering approach to design of plates and continuously supported floor slabs – Application of flat plate theory to design of flat slabs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Apply various plate theories in design.
- Analyze rectangular plates using Navier's solution, Levy's solution.
- Analyze circular plates for the given boundary conditions.
- Solve plates using finite difference method.
- Analyze the various types of orthotropic and thick plates under different loading conditions.

TEXT BOOKS

1. Reddy J N, "Theory and Analysis of Elastic Plates and Shells", McGraw Hill Book Company, 2nd Edition, 2016.
2. Szilard. R "Theory and Analysis of Plates-Classical and Numerical Methods", Wiley, 4th Edition, 2017.

REFERENCES

1. Ansel C. Ugural, " Plates and Shells Theory and Analysis ", CRC Press, 4th Edition, 2017.
2. Chandrashekhara K, Theory of Plates, University Press (India) Ltd., 3rd Edition, 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/112/103/112103251/ (Theory of Rectangular Plates)
2. https://nptel.ac.in/courses/105/103/105103209/ (Plates and Shells)

21PSP312 **SOIL STRUCTURE INTERACTION** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Develop an idea about soil–foundation interaction.
- Analyze beams of finite length.
- Analyze the finite plates by numerical method.
- Perform elastic analysis of pile.
- Study retaining structures in soil structure interaction.

UNIT I: INTRODUCTION **9**

Introduction to soil – Foundation interaction problems – soil behavior – Foundation behavior – Interface behavior – Scope of soil foundation interaction analysis – Soil response models – Winkler, Elastic continuum – Two parameter elastic models – Elastic plastic behaviour – Time dependent behaviour.

UNIT II: BEAM ON ELASTIC FOUNDATION **9**

Infinite beam – Two parameters – Isotropic elastic half space – Analysis of beams of finite length – Classification of finite beams in relation to their stiffness.

UNIT III: PLATES ON ELASTIC CHANNEL **9**

Thin and thick rafts – Analysis of finite plates – Numerical analysis of Pile – Analysis of finite plates.

UNIT IV: ANLYSIS OF PILE **9**

Elastic analysis of single pile – Theoretical solutions for settlement and load distributions – Analysis of pile group – Interaction analysis – Load distribution in groups with rigid cap.

UNIT V: SSI IN RETAINING STRUCTURES **9**

Curved failure surfaces, their utility and analytical / graphical predictions from Mohr-Coulomb envelope and circle of stress – Earth pressure computations by friction circle method – Earth pressure on wall with limited / restrained deformations – Earth pressure on sheet piles, braced excavations – Design of supporting system for excavations.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Illustrate the overview of soil– structure interactions.
- Analyze the behavior of the soil under elastic and plastic condition as beam element.
- Analyze the behavior of the soil as plate element.
- Predict the behavior of the pile under static and dynamic loads.
- Analyze the soil structure interaction involved in retaining structures.

TEXT BOOKS

1. Alexander Tyapin, "Soil-structure interaction in seismic analysis", Asv Publications, 1st Edition, 2019.
2. A.S. Cakmak, "Soil-Structure Interaction", Elsevier Science, 1st Edition, 2016.

REFERENCES

1. Chandrakant S. Desai, Musharraf Zaman. "Advanced Geotechnical Engineering – Soil–Structure Interaction using Computer and Material Models", CRC Press, 1st Edition, 2016.
2. Poulos, H.G., and Davis, E.H, "Pile Foundation Analysis and Design", John Wiley, 1st Edition, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/105/105/105105200/ (Soil Structure Interaction)
2. https://nptel.ac.in/courses/105/106/105106052/ (Geo-synthetics and Reinforced Soil Structure)

21PSP313 **CORROSION ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn electro chemical corrosion.
- Understand the various types of testing in corrosion.
- Study about the prevention of corrosion.
- Understand the corrosion in selected environment.
- Identify corrosion related issues in various industries.

UNIT I: CORROSION **9**

General – Electrochemical corrosion of metals – Galvanic cells – Corrosion rates (kinetics) – Types of corrosion with properties and phenomenon – Oxidation metals.

UNIT II: CORROSION TESTING **9**

Importance, classification – Materials and specimens – Surface preparation – Measuring and weighing – Exposure techniques – Duration, planned interval tests.

UNIT III: CORROSION PREVENTION **9**

Material selection – Modification of metal – Alternate of environment – Design – Cathodic and anodic protection – Coatings (metallic, inorganic, non metallic and organic)

UNIT IV: CORROSION IN SELECTED ENVIRONMENT **9**

Atmospheric Corrosion – Corrosion in Automobiles – Corrosion in Soils – Corrosion of Steel in Concrete – Corrosion in Water – Microbiologically Induced Corrosion – Corrosion in the Body.

UNIT V: CORROSION IN INDUSTRIES **9**

Corrosion in the Petroleum Industry – Corrosion in the Aircraft Industry – Corrosion in the Microelectronics Industry.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the causes and mechanism of various types of corrosion.
- Conduct various tests for corrosion measurement.
- Apply suitable techniques for corrosion prevention.
- Identify the occurrence of corrosion under different environment.
- Resolve corrosion related issues in various industries.

TEXT BOOKS

1. Sadasivam, V. "Modern Engineering Chemistry – A Simplified Approach", Kamakya Publications, 1st Edition, 2017.
2. Jones D.A. "Principles and Prevention of Corrosion", Macmillan Publishing Co, 2nd Edition, 2020.

REFERENCES

1. Kuriakose, J.C. and Rajaram J. "Chemistry in Engineering and Technology", Vol. I and II, Tata McGraw–Hill Publications Co. Ltd, 2nd Edition, 2016.
2. Balasubramanian, M.R., Krishnamoorthy, S. and Murugesan, V., "Engineering Chemistry", Allied Publisher Limited, 2nd Edition, Chennai, 2016.

E–RESOURCES

1. https://nptel.ac.in/courses/113/104/113104082/ (Corrosion Part–I)
2. https://nptel.ac.in/courses/113/104/113104089/ (Corrosion Part–II)

21PSP314 MAINTENANCE AND REHABILITATION OF STRUCTURES L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the causes of distress.
- Study the reasons of crack formations.
- Recognize deterioration of concrete buildings.
- Apply the repair procedure for steel constructions.
- Aware the strengthening techniques for prevailing structures.

UNIT I: DIAGNOSE OF DISTRESS **9**

General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal.

UNIT II: BUILDING CRACKS **9**

Building Cracks – Diagnosis, Causes and Remedial measures – Thermal and Shrinkage cracks – Unequal loading – Vegetation and trees – Chemical action – Foundation movements – Techniques for repair – NDT techniques, Grouting, Epoxy injection – Repair materials – Special concretes and mortar.

UNIT III: REPAIR OF CONCRETE STRUCTURES **9**

Introduction – Causes of deterioration – Diagnosis of cracked structures – Methods of repair – Repairing, spalling and disintegration – Repairing of concrete floors and pavements.

UNIT IV: REPAIR OF STEEL STRUCTURES **9**

Types and causes for deterioration – Preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Corrosion production methodologies – Design and fabrication errors – Distress during erection – Causes and remedies.

UNIT V: STRENGTHENING OF EXISTING STRUCTURES **9**

General principles – Relieving loads – Strengthening super structures – Plating – Conversion to composite construction – Post stressing – Jacketing – Bonded overlays – Reinforcement addition – Strengthening substructures – Under pinning – Increasing load capacity of footing – Design for rehabilitation – Strength enhancement of steel structures.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Diagnose the distress in civil engineering structures.
- Apply the theoretical concepts of crack repairing in the field.
- Select suitable repair techniques for deterioration of concrete structures.
- Pick right techniques to eliminate distressing in steel arrangements.
- Apply strengthening concepts for existing structures.

TEXT BOOKS

1. Guha, P.K, “Maintenance and Repairs of Buildings”, New Central Book Agency (P) Ltd, 1st Edition, 2016.
2. Modi, P.I., Patel, C.N., "Repair and Rehabilitation of Concrete Structures", PHI India, 1st Edition, 2016.

REFERENCES

1. Chudley R, “The Maintenance and Adaptation of Buildings”, Longman Group Ltd, 2nd Edition, 2017.
2. Shetty, M.S, “Concrete Technology - Theory and Practice”, S. Chand and Company Ltd, 8th Edition, 2019.

E–RESOURCES

1. https://nptel.ac.in/courses/105/106/105106202/ (Maintenance and Repair of Concrete Structures)
2. https://www.digimat.in/nptel/courses/video/105106202/L31.html (Maintenance and Repair of Concrete Structures)

21PSP315 **SMART STRUCTURES** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Describe the basic principles and mechanisms of smart materials and devices.
- Demonstrate parallel damped and gyroscopic vibration absorber.
- Describe the basic principles and mechanisms of measuring techniques.
- Classify various control systems in structures.
- Understand the applications of shape memory and smart bridges.

UNIT I: PROPERTIES OF MATERIALS & ER AND MR FLUIDS **9**

Piezoelectric Materials and properties – Actuation of structural components – Shape Memory Alloys – Constitutive modeling of the shape memory effect, vibration control – Embedded actuators – Electro rheological and magneto rheological fluids – Mechanisms and Properties – Fiber Optics – Fibre characteristics – Fiber optic strain sensors.

UNIT II: VIBRATION ABSORBERS **9**

Parallel damped vibration absorber – Gyroscopic vibration absorber – Active vibration absorber – Applications – Vibration Characteristics of mistuned systems – Analytical approach.

UNIT III: MEASURING TECHNIQUES **9**

Strain measuring techniques using electrical strain gauges – Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT IV: CONTROL OF STRUCTURES **9**

Control modeling of structures – Control strategies and limitations – Classification of control systems – Classical control, Modern control, optimal control and digital control – Active structures in practice.

UNIT V: APPLICATIONS IN CIVIL ENGINEERING **9**

Application of shape memory – Alloys in bridges – Concept of smart bridges – Application of ER fluids – Application of MR dampers in different structures – Application of MR dampers in bridges and high rise structures – Structural health monitoring – Application of optical fibres – Concept of smart concrete.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Classify various smart materials and devices.
- Formulate analytical approach on vibration absorbers.
- Demonstrate strain measurement using smart materials.
- Develop control strategies for smart structures.
- Use dampers for health monitoring of structures.

TEXT BOOKS

1. Azfal Suleman, "Smart Structures Applications and Related Technologies", Springer, 1st Edition, 2018.
2. Srinivasan, A.V.,and Michael McFarland D, "Smart Structures - Analysis and Design", Cambridge University Press, 1st Edition, 2016.

REFERENCES

1. Brian Culshaw, "Smart Structures and Materials", Artech House, 3rd Edition, 2018.
2. Gandhi. M.V and Thompson. B.S., "Smart Materials and Structures", Chapman and Hall, 1st Edition, 2018.

E–RESOURCES

1. https://nptel.ac.in/courses/112/104/112104173/ (Smart Materials)
2. https://nptel.ac.in/courses/112/104/112104251/ (Smart Materials)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING
FOR M.E. VLSI DESIGN

SEMESTER I

21PVM101 GRAPH THEORY AND OPTIMIZATION TECHNIQUES L T P C 4 0 0 4

OBJECTIVES

The main objective of this course is to:

- Explore modern applications of graph theory using matrices and to study proof techniques related to various concepts in Trees.
- Study proof techniques related to various concepts in Spanning Trees, Connectivity andplanar graphs.
- Be exposed to the techniques of proofs in coloring and digraphs.
- Understand the concepts of various linear programming methods.
- Understand the concepts of duality, transportation model and assignment model.

UNIT I: GRAPH THEORY **9+3**

Fundamental concepts of graph – Special types of Graphs –Walks, Paths and Circuits in graphs –Euler graphs – Hamiltonian graphs – Matrix representation of Graphs – Trees – Properties of Trees– Distance and Centers in a Tree – Rooted and binary Trees.

UNIT II: CONNECTIVITY AND PLANARITY **9+3**

Spanning Trees – Spanning Trees in a weighted graph – Minimal spanning Trees – The algorithms of Kruskal and Prim – Cut-sets – Properties of a cut-set – Fundamental circuits and cut-sets – Connectivity and Separability – Planar graphs – Representations of a Planar graphs

UNIT III: COLORING AND DIRECTED GRAPHS **9+3**

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matchings – Coverings – The Four color problem– Digraphs – Types of Digraphs – Digraphs and binary relations – Euler Digraph.

UNIT IV: LINEAR PROGRAMMING **9+3**

Introduction – Formulation of Linear Programming – Graphical method – Simplex method – Big Mmethod — Two-phase method.

UNIT V: DUALITY AND TRANSPORTATION MODEL **9+3**

Formulation of Dual problem – Application of Duality – Dual Simplex method – Definition of the Transportation Model – Nontraditional Transportation Models – The Transportation Algorithm – Assignment Model.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- The basic concepts of graphs, different types of graphs and properties of Trees.
- The properties, theorems and be able to prove theorems.
- Apply suitable graph model and algorithm for solving applications.
- Solve optimization problems using Linear Programming methods.
- Apply integer programming and linear programming to solve real-life applications.

TEXT BOOKS

1. Narsingh Deo, "Graph Theory: With Applications to Engineering and Computer Science", Prentice Hall of India Learning Private Limited, Delhi, 2016.
2. Hamdy A. Taha, "Operations Research", Pearson Education, New Delhi, 2017.

REFERENCES

1. John Clark and Derek Allan Holton, "A First Look at Graph Theory", World ScientificPublishing Company, 1991.
2. Panneerselvam R, "Operations Research", PHI Learning private limited, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/111/106/111106102/(Graph Theory)
2. https://nptel.ac.in/courses/111/102/111102012/(Linear Programming Problems)

21PGT101	RESEARCH METHODOLOGY AND IPR (Common to all PG Engineering Courses)	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Identify problem formulation, analysis and solutions.
- Know the effective literature study approaches.
- Write Technical papers / presentations without violating professional ethics.
- Understand the process of process and procedure of patenting.
- Gain basic knowledge on intellectual property rights.

UNIT I: RESEARCH PROBLEM **9**

Meaning of research problem – Sources of research problem – criteria characteristics of a good research problem – errors in selecting a research problem – scope and objectives of research problem – Approaches of investigation of solutions for research problem – data collection – analysis – interpretation – necessary instrumentations.

UNIT II: LITERATURE REVIEW **9**

Effective literature studies approaches – analysis – plagiarism and research ethics.

UNIT III: TECHNICAL WRITING /PRESENTATION **9**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee**.**

UNIT IV: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Nature of Intellectual Property – Patents, Designs – Trade and Copyright – Process of Patenting and Development: technological research – Innovation, patenting, development – International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents, Patenting under PCT.

UNIT V: INTELLECTUAL PROPERTY RIGHTS(IPR) **9**

Patent Rights: Scope of Patent Rights – Licensing and transfer of technology – Patent information and databases – Geographical Indications – New Developments in IPR: Administration of Patent System – IPR of Biological Systems, Computer Software etc – Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Formulate research problems.
- Carry out research analysis.
- Write technical papers/presentations.
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow the world will be ruled by ideas, concepts, and creativity.
- Understand about IPR and filing patents in R & D.

TEXT BOOKS

1. Ranjith Kumar, "Research Methodology: A step–by–step guide for beginners", SAGE Publications, 4th edition, 2014.
2. Neeraj Pandey, KhushdeepDhrani, "Intellectual Property Rights", PHI Learning Private Limited, 2014.

REFERENCES

1. Heather Silyn–Roberts, "Writing for Science and Engineering: Papers, Presentationsand Reports", Elsevier, 2nd edition, 2013.
2. Douglas C. Montgomery, "Design and Analysis of Experiments", 9th edition, Wiley Publishers, 2017.

E–RESOURCES

1. https://nptel.ac.in/courses/121/106/121106007/(Introduction to Research)
2. https://nptel.ac.in/courses/109/106/109106137/(IPR)

21PVT101 **DEVICE MODELING** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn the basics of MOS physics and modeling of MOS structures.
- Acquire sound knowledge in noise modeling and accurate distortion analysis in analog circuits.
- Understand the concept of BSIM modeling and other MOSFET models
- Study the concept of non-quasi-static modeling and noise model temperature effects
- Impart knowledge of small signal modeling.

UNIT I: BASIC DEVICE PHYSICS-I **9**

Two Terminal MOS Structure Flat-band voltage, Potential balance & charge balance, Effect of Gate-substrate voltage on surface condition, Inversion, Small signal capacitance; C-VCharacteristics.

Three Terminal MOS Structure

Contacting the inversion layer, Body effect, Regions of inversion, Pinch-off voltage.

UNIT II: BASIC DEVICE PHYSICS-II **9**

Four Terminal MOS Transistor

Transistor regions of operation, general charge sheet models, regions of inversion in terms of terminal voltage, strong inversion, weak inversion, moderate inversion, interpolation models, effective mobility, temperature effects, breakdown p-channel MOS FET, enhancement and depletion type, model parameter values, model accuracy.

UNIT III: MOS TRANSISTOR WITH ION-IMPLANTED CHANNELS **9**

Enhancement of nMOS, Depletion nMOS, Enhancement pMOS**.**

Small dimension effects: Channel length modulation, barrier lowering, two-dimensional charge sharing and threshold voltage, punch-through, carrier velocity saturation, hot carrier effects, scaling, effects of surface and drain series resistance, effects due to thin oxides and high doping. Sub threshold regions, short channel effects.

UNIT IV: MOS TRANSISTOR IN DYNAMIC OPERATION **9**

Large Signal modeling: Quasi static operation, Terminal currents in Quasi static operation, Evaluation of Charges in Quasi static operation, Transit time under DC conditions, Limitations of Quasi static Model, Non Quasi static Analysis.

UNIT V: SMALL SIGNAL MODELING FOR LOW, MEDIUM AND HIGH FREQUENCIES **9**

Low, Medium frequency small signal model for the intrinsic part, small signal model for Extrinsic Part, A complete Quasi static Model, Y-Parameter models, non-Quasi static Models.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Extend in depth knowledge in various characteristics of MOS Transistors..
- Analyze complex MOS device structures.
- Solve engineering problems with wide range of solutions in different MOSFET technologies.
- Identify the characteristics of MOSFET in dynamic operation.
- Apply appropriate techniques, resources and tools to engineering activities in modelling MOS structures.

TEXT BOOKS

1. Yannis Tsividis, "Operation and modelling of the MOS Transistor", Oxford University press, 2011.
2. Trond Ytterdal,Yuhua cheng and Tor Fjeldly, "Device modelling for Analog and RF CMOS Circuit Design" Wiley publications,2003.

REFERENCES

1. Donald A Neamen and Dhrubes Biswas, "Semiconductor physics and Devices" Special Indian Edition,4 th edition,2012.
2. M.S.Tyagi, "Introduction to Semiconductor materials and Devices" Wiley 2008.

E- RESOURCES

1. https://digimat.in/nptel/courses/video/117106033/L01 (Semiconductor modeling).
2. https://nptel.ac.in/courses/108/108/108108112/(Semiconductor Devices and Circuits)

21PVT102 **SYSTEM DESIGN USING FPGA** **L T P C**
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Learn the advanced design and analysis of digital circuits with HDL.
- Provide in depth understanding of logic and system design.
- Enables students to apply their knowledge for the design of advanced digital hardwaresystems with help of FPGA tools.
- Understand the concepts of FPGA and its architecture.
- Knowledge about System level Design.

UNIT I: VERILOG HDL CODING STYLE **9**

Lexical Conventions - Ports and Modules — Operators - Gate Level Modeling - System Tasks & Compiler Directives - Test Bench - Data Flow Modeling - Behavioral level Modeling -Tasks & Functions.

UNIT II: VERILOG MODELING OF COMBINATIONAL & SEQUENTIAL CIRCUITS **9**

Behavioral, Data Flow and Structural Realization – Adders – Multipliers- Comparators - Flip Flops Realization of Shift Register - Realization of a Counter- Synchronous and Asynchronous FIFO – Single port and Dual port RAM – Pseudo Random LFSR – Cyclic Redundancy Check.

UNIT III: SYNCHRONOUS SEQUENTIAL CIRCUIT **9**

State diagram-state table –state assignment-choice of flip-flops — Timing diagram –One hot encoding- Mealy and Moore state machines – Design of serial adder using Mealy and Moore state machines - State minimization – Sequence detection- Design of vending machine using One Hot Controller

UNIT IV: FPGA AND ITS ARCHITECTURE **9**

Types of Programmable Logic Devices- PLA & PAL- FPGA Generic Architecture. ALTERA CycloneII Architecture – Timing Analysis and Power analysis using Quartus-II- SOPC Builder NIOS-II Soft- core Processor- System Design Examples using ALTERA FPGAs — Traffic light Controller, Real Time Clock - Interfacing using FPGA: VGA, Keyboard, LCD.

UNIT V: SYSTEM LEVEL DESIGN **9**

Controller, data path designing, Functional partition, Digital front end digital design tools for FPGAs & ASICs, System level design using mentor graphics EDA tool(FPGA Advantage), Design flow using CPLDs and FPGAs. CASE STUDIES: Design considerations using CPLDs and FPGAs of parallel adder cell, parallel adder sequential circuits, counters, multiplexers, parallel controllers.

LIST OF EXPERIMENTS

1. Design and implementation of arithmetic circuits.
2. Design and implementation of real time clock and controller.
3. Design and implementation of memory modules and filters.
4. Interfacing with ADC/DAC and display modules.

TOTAL: 45+15= 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Design and manually optimize complex combinational and sequential digital circuits.
- Model combinational and sequential digital circuits by Verilog HDL.
- Design of FPGA based systems,digital networks,architectures and large systems.
- Demonstrate various aspects in Large Scale Digital Systems design.
- Impart knowledge of interfacing and display modules.

TEXT BOOKS

1. S. Ramachandran, "Digital VLSI System Design: A Design Manual for implementation ofProjects on FPGAs and ASICs Using Verilog" Springer Publication, 2007.
2. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall,2nd Edition, 2003.

REFERENCES

1. Mark Balch, "Complete Digital design – A Comprehensive Guide to Digital Electronics and Computer system Architecture," McGraw Hill, 2003.
2. Stephen Brown &Zvonko Vranesic, "Digital Logic Design with VerilogHDL" TATA McGrawHill Ltd. 2nd Edition 2007.

E-RESOURCES

1. https://nptel.ac.in/courses/117/108/117108040/(Digital system design with PLDs and FPGAs)
2. http://www.nptelvideos.in/2012/12/digital-vlsi-system-design.html - (Digital VLSI System Design)

21PVE101 **CMOS DIGITAL VLSI DESIGN** **L T P C**
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Analyze comprehensively with all aspects of transistor level design.
- Design the digital building blocks common to all CMOS microprocessors, DPSs, networkprocessors.
- Understand the basic concepts about MOS device and inverter characteristics II.
- Able to use mathematical methods and circuit analysis models in analysis of CMOS digitalelectronics circuits, including logic components and their interconnect.
- Design static CMOS combinational and sequential logic at the transistor level, including mask layout.
- Carry out complete hardware level FGPA validation of important digital algorithms.

UNIT I: MOS TRANSISTOR PRINCIPLES AND CMOS INVERTER **9**

MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, MOS Transistor Secondary Effects, Process Variations, Technology Scaling, Internet Parameter and electrical wise models CMOS Inverter - Static Characteristic, Dynamic Characteristic, Power, Energy, and Energy Delay parameters.

UNIT II: COMBINATIONAL LOGIC CIRCUITS **9**

Propagation Delays, Stick diagram, Layout diagrams, Examples of combinational logic design, Elmore‟s constant, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III: SEQUENTIAL LOGIC CIRCUITS **9**

Static Latches and Registers, Dynamic Latches and Registers, Timing Issues, Pipelines, Pulse and sense amplifier-based Registers, non bistable Sequential Circuits.

UNIT IV: ARITHMETIC BUILDING BLOCKS AND MEMORY ARCHITECTURES **9**

Data path circuits, Architectures for Adders, Accumulators, Multipliers, Barrel Shifters, Speed and Area Tradeoffs, Memory Architectures, and Memory control circuits.

UNIT V: INTERCONNECT AND CLOCKING STRATEGIES **9**

Interconnect Parameters — Capacitance, Resistance, and Inductance, Electrical Wire Models, Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

LIST OF EXPERIMENTS

1. Understanding Synthesis principles, Back annotation.
2. Test vector generation and timing analysis of sequential and combinational logic designrealized using HDL languages.
3. FPGA real time programming and I/O interfacing.
4. To plot the (i) output characteristics (ii) Transfer characteristics of an n-channel and p-channel MOSFET.
5. Design and plot the static (VTC) and dynamic characteristics of a digital CMOS inverter.
6. Modeling and simulation of combinational and sequential circuits using verilog.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Use mathematical methods and circuit analysis models in analysis of CMOS digital circuits.
- Create models of moderately sized static CMOS combinational circuits that realize specified digital functions and to optimize combinational circuit delay using RC delay models and logic effort.
- Design sequential logic at the transistor level and compare the tradeoffs of sequencing elements including flip-flops, transparent latches.
- Understand design methodology of arithmetic building blocks.
- Apply the knowledge of CMOS in various clocking strategies processes.
- Map into the FGPA platform and carry out a serious of validation design.

TEXT BOOKS

1. Jan Rabaey, AnanthaChandrakasan, B Nikolic, "Digital Integrated Circuits: A Design Perspective". 2nd Edition, Feb 2003, Prentice Hall of India.
2. Jacob Baker "CMOS: Circuit Design, Layout, and Simulation, Third Edition", Wiley IEEEPress 2010 3rd Edition.

REFERENCES

1. M J Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997.
2. N.Weste, K. Eshraghian, " Principles of CMOS VLSI Design". 2nd Edition, 1993 AddisionWesley.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ee09/(CMOS VLSI Design)
2. https://nptel.ac.in/courses/108/107/108107129/ (MOS Transistor)

21PEE101 RESEARCH PAPER WRITING AND SEMINAR L T P C
1 0 0 0

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and thenplace it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers).
4. Preparing a draft outline of research work.
5. Studying the papers and understanding the authors contributions and critically analyzing each paper.
6. Linking the papers and preparing a draft of the paper.
7. Preparing conclusions based on the reading of all the papers.
8. Writing the Final Paper and giving final Presentation.
9. Maintaining a file for records of activities.

Activities to be carried out

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic Stating an Objective	1. Select an area of interest and topic. 2. State the objectives.	2nd week	**3%** Based on clarity of thought, current relevance and clarity in writing
Collecting Information about the area & topic	1. List one special interest groups or professional society. 2. List two journals. 3. List two conferences, symposia or workshops. 4. List one thesis title. 5. List three web presences (mailing lists,forums,news sites) 6. List three authors who publish regularly in the area 7. Attach a call for papers (CFP) from the area.	3rd week	**3%** (the selected information must be area specific and of international and national standard)

Collection of Journal papers in the topic in the context of the objective - collect 20 & then filter	• Provide a complete list of references based on the objectives • Search various digital libraries and Google Scholar • Collect recent papers related to research area so that to write a meaningful survey out of them, • Do a recent survey of the field. • Find relationships of base paper with respect to other literature concerned. (Classification scheme / categorization). • Mark in the hard copy of papers whether completes work or section/sections of the paper are being considered.	4th week	**6%** (the list of standard papers and reason for selection)
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other's work, in the author's opinion? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research?	5th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)

	Conclude with limitations/issues not addressed by the paper (from the perspective of the survey)		
Reading and notes for next 5 papers	Repeat Reading Paper Process	6th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Reading and notes for final 5 papers	Repeat Reading Paper Process	7th week	**8%** (the table given should indicate the understanding of the paper and the evaluation is based on the conclusions about each paper)
Draft outline 1 and Linking papers	Prepare a draft outline for survey goals, along with a classification / categorization diagram	8th week	**8%** (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9th week	**6%** (Clarity, purpose and conclusion) **6%** Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	**5%** (clarity)

Sections of the paper	Write the sections of the paper based on the classification / categorization diagram in keeping with the goals of the survey.	11th week	**10%**(this component will be evaluated based on the linking and classification amongthe papers)
Conclusions	Write conclusions and future work.	12th week	**5%** (conclusions – clarity and ideas)
Final Draft	Complete the final draft of the paper.	13th week	**10%** (formatting, English, Clarity and linking) **4%** Plagiarism Check Report
Seminar	Prepare for Final Presentation.	14th& 15th week	**10%** (based on presentation and viva-voce)

TOTAL: 30 PERIODS

SEMESTER II

21PVT201	**TESTING OF VLSI CIRCUITS**	**L T P C** **3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Understand logic fault models.
- Learn test generation for sequential and combinational logic circuits.
- Design for testability.
- Demonstrate self-test algorithms.
- Knowledge about fault diagnosis.

UNIT I: VERILOG HDL CODING STYLE **9**

Introduction to testing – Faults in Digital Circuits – Modelling of faults – Logical Fault Models – Fault detection — Fault Location — Fault dominance — Logic simulation — Types of simulation — Delay models-Gate Level Event – driven simulation.

UNIT II: TEST GENERATION **9**

Test generation for combinational logic circuits – Testable combinational logic circuit design – Test generation for sequential circuits – design of testable sequential circuits.

UNIT III: DESIGN FOR TESTABILITY **9**

Design for Testability – Ad-hoc design – generic scan-based design – classical scan-based design– system level DFT approaches.

UNIT IV: SELF – TEST AND TEST ALGORITHMS **9**

Built-In self-test – test pattern generation for BIST – Circular BIST – BIST Architectures – TestableMemory Design – Test Algorithms – Test generation for Embedded RAMs.

UNIT V: FAULT DIAGNOSIS **9**

Logical Level Diagnosis – Diagnosis by UUT reduction – Fault Diagnosis for Combinational Circuits– Self-checking design – System Level Diagnosis.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Discuss test algorithms.
- Understand Verilog HDL coding.
- Prepare design for testability.
- Design test generation.
- Explain fault diagnosis.

TEXT BOOKS

1. A.L.Crouch ,"Design Test for Digital IC's and embedded Core Systems ",Prentice Hall International, 2002.
2. M.Abramovici, M.A.Breuer and A.D. Friedman, "Digital systems and Testable Design",Jaico Publishing House, 2002.

REFERENCES

1. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory andMixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2002.
2. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_ee76/preview(Digital VLSI Testing).
2. https://nptel.ac.in/courses/106/103/106103116/(Design Verification and Test of Digital VLSI circuits).

21PVT202 **CAD FOR VLSI CIRCUITS** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Learn VLSI Design methodologies.
- Understand VLSI design automation tools.
- Design floor planning and routing.
- Study modeling and simulation.
- Impart knowledge of High level synthesis.

UNIT I: INTRODUCTION TO VLSI DESIGN FLOW **9**

Introduction to VLSI Design methodologies, Basics of VLSI design automation tools, Algorithmic Graph Theory and Computational Complexity, Tractable and Intractable problems, General purpose methods for combinatorial optimization.

UNIT II: LAYOUT, PLACEMENT AND PARTITIONING **9**

Layout Compaction, Design rules, Problem formulation, Algorithms for constraint graph compaction, Placement and partitioning, Circuit representation, Placement algorithms, Partitioning.

UNIT III: FLOOR PLANNING AND ROUTING **9**

Floor planning concepts, Shape functions and floor plan sizing, Types of local routing problems, Area routing, Channel routing, Global routing, Algorithms for global routing.

UNIT IV: SIMULATION AND LOGIC SYNTHESIS **9**

Simulation, Gate-level modeling and simulation, Switch-level modeling and simulation, Combinational Logic Synthesis, Binary Decision Diagrams, Two Level Logic Synthesis.

UNIT V: HIGH LEVEL SYNTHESIS **9**

Hardware models for high level synthesis, internal representation, allocation, assignment and scheduling, scheduling algorithms, Assignment problem, High level transformations.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Understand VLSI design methodologies.
- Design layout, placement and partitioning.
- Outline floor planning and routing.
- Explain Simulation and Logic Synthesis.
- Discuss the hardware models for high level synthesis.

TEXT BOOKS

1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers,2002.
2. S.H. Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.

REFERENCES

1. Sadiq M. Sait, Habib Youssef, "VLSI Physical Design automation: Theory and Practice",World Scientific1999.
2. Steven M.Rubin, "Computer Aids for VLSI Design", Addison Wesley Publishing1987.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106088/(CAD for VLSI Design).
2. https://onlinecourses.nptel.ac.in/noc21_cs96/preview(C-Based VLSI Design).

21PVE201 **ANALOG IC DESIGN** **L T P C**
3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Study MOS devices modelling and scaling effects.
- Familiarize the design of single stage and multistage MOS amplifier.
- Understand the analysis of single stage and multistage MOS amplifier frequency responses.
- Study the different design parameters in designing voltage reference circuit.
- Impart knowledge on OPAMP circuit.
- Demonstrate experiments to understand basic of VLSI based experiments.

UNIT I: MOSFET METRICS **9**

Simple long channel MOSFET theory — SPICE Models — Technology trend, Need for Analog design - Sub-micron transistor theory, short channel effects, Narrow width effect, drain induced barrier lowering, Sub-threshold conduction, Reliability, Digital metrics, Analog metrics, small signal parameters, Unity Gain Frequency, Miller's approximation.

UNIT II: SINGLE STAGE AND TWO STAGE AMPLIFIERS **9**

Single Stage Amplifiers — Common source amplifier with resistive load, diode load, constant current load, Source degeneration Source follower, Input and output impedance, Common gate amplifier - Differential Amplifiers — differential and common mode response, Input swing, gain, diode load and constant current load - Basic Two Stage Amplifier, Cut-off frequency, poles and zeros.

UNIT III: FREQUENCY RESPONSE OF SINGLE STAGE AND TWO STAGE AMPLIFERS **9**

Frequency Response of Single Stage Amplifiers – Noise in Single stage Amplifiers – Stability and Frequency Compensation in Single stage Amplifiers, Frequency Response of Two Stage Amplifiers-Noise in two stage Amplifiers — Stability, gain and phase margins, Frequency Compensation in two stage Amplifiers, Effect of loading in feedback networks.

UNIT IV: CURRENT MIRRORS AND REFERENCE CIRCUITS **9**

Cascode, Negative feedback, Wilson, Regulated cascode, Bandgap voltage reference, Constant Gm biasing, supply and temperature independent reference, curvature compensation, trimming, Effect of transistor mismatch in analog design.

UNIT V: OP AMPS **9**

Gilbert cell and applications, Basic two stage OPAMP, two-pole system response, common mode and differential gain, Frequency response of OPAMP, CMFB circuits, slew rate, power supply rejection ratio, random offset, systematic offset, Noise, Output stage, OTA and OPAMP circuits – Low voltage OPAMP.

LIST OF EXPERIMENTS

1. Determination of small signal parameters.
2. Design and simulation of single stage amplifiers frequency response.
3. Design and simulation of differential amplifiers.
4. Design and simulation of operational amplifiers.
5. Design and simulation of data converters.
6. Design and simulation of PLL.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Study the performance characteristics of MOSFET Metrics.
- Understand single stage and Two stage Amplifiers.
- Analyze of single stage and multistage MOS amplifier frequency responses.
- Understand current mirrors and reference circuits.
- Design MOS single stage, multistage amplifiers and OPAMP for desired frequencies.
- Known the simulated concepts of small signal parameters.

TEXT BOOKS

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2000.
2. Philip E.Allen, "CMOS Analog Circuit Design", Oxford University Press, 2013.

REFERENCES

1. Paul R.Gray, "Analysis and Design of Analog Integrated Circuits", Wiley Student edition, 5th edition, 2009.
2. R.Jacob Baker, "CMOS: Circuit Design, Layout , and Simulation", Wiley Student Edition, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/117/106/117106030/(Analog IC Design).
2. https://onlinecourses.nptel.ac.in/noc21_ee51/preview(Analog IC Design).

21PEE201 **MINI PROJECT** **L T P C**
0 0 2 1

OBJECTIVES

The main objective of this course is to:

- Design and fabrication of one or more components working model, which is designed bythem.
- Ability to fabricate any components using different manufacturing tools.

GUIDELINES

A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the mini project, and submit it to the department in a prescribed report form.

TOTAL: 30 PERIODS

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment):100 marks.
   (Decided by review committee consist of HoD,Guide and senior faculty member conducting 3 reviews)

OUTCOMES

- At the end of the course project the students will understand the formulated industry / technical / societal problems. Analyze and / or develop models for providing solution to industry / technical / societal problems. Interpret and arrive at conclusions from the project carried out. Demonstrate effective communication skills through oral presentation. Engagein effective written communication through project report.

SEMESTER III

21PEE301	PROJECT WORK PHASE–I	L T P C 0 0 12 6

OBJECTIVES

The main objective of this course is to:

- Identify a specific problem for the current need of the society and collecting informationrelated to the same through detailed review of literature.
- Develop the methodology to solve the identified problem.
- Train the students in preparing project reports and to face reviews and viva– voce examination.

GUIDELINES

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition ofthe identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva–voce examination by a panelof examiners including one external examiner.

TOTAL: 180 PERIODS

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment):40 marks.
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews)
2. End semester assessment (Evaluation of Project Report & Viva voce examination):60 marks. (Evaluated by the internal & external examiner appointed by the CoE and approval by HoD)

OUTCOMES

- At the end of the course project the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

SEMESTER IV

21PEE401	PROJECT WORK PHASE – II	L T P C 0 0 24 12

OBJECTIVES

The main objective of this course is to:

- Solve the identified problem based on the formulated methodology.
- Develop skills to analyze and discuss the test results, and make conclusions.
- Train the students in preparing project reports and to face reviews and viva– voce examination.

GUIDELINES

The student should continue the phase–I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 360 PERIODS

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks (Continuous Assessment): 40 marks.
   (Decided by review committee consist of HoD, Guide and senior faculty member conducting 3 reviews)
2. End semester assessment (Evaluation of Project Report & Viva voce examination): 60 marks. (Evaluated by the internal & external examiner appointed by the CoE and approval by HoD)

OUTCOMES

- On completion of the project work students will be in a position to take up any challengingpractical problem and find better solutions.

PROFESSIONAL ELECTIVE I

21PVP101 **LOW POWER VLSI DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Identify sources of power in an IC.
- Identify the power reduction techniques based on technology independent and technology dependent.
- Power dissipation mechanism in various MOS logic style.
- Identify suitable techniques to reduce the power estimation.
- Acquire sound knowledge about software design for low power.

UNIT I: POWER DISSIPATION IN CMOS **9**

Physics of power dissipation in CMOS FET devices – Hierarchy of limits of power – Sources ofpower consumption — Static Power Dissipation, Active Power Dissipation - Designing for LowPower, Circuit Techniques For Leakage Power Reduction - Basic principle of low power design.

UNIT II: POWER OPTIMIZATION **9**

Logic level power optimization — Circuit level low power design — Standard Adder Cells, CMOS Adders Architectures-BiCMOS adders - Low Voltage Low Power Design Techniques, Current Mode Adders -Types of Multiplier Architectures, Braun, Booth and Wallace Tree Multipliers andtheir performance comparison.

UNIT III: DESIGN OF LOW POWER CMOS CIRCUITS **9**

Computer arithmetic techniques for low power system – low voltage low power static Randomaccess and dynamic Random-access memories – low power clock, Inter connect and layoutdesign – Advanced techniques – Special techniques.

UNIT IV: POWER ESTIMATION **9**

Power Estimation techniques — logic power estimation — Simulation power analysis — Probabilistic power analysis.

UNIT V: SYNTHESIS AND SOFTWARE DESIGN FOR LOW POWER **9**

Synthesis for low power – Behavioral level transform – software design for low power.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Know the basics and advanced techniques in low power design.
- Design of low power VLSI optimized circuits.
- Implement suitable techniques of low power CMOS circuits.
- The reduction in power estimation by an IC earns a lot including reduction in size, cost and etc.
- Understand synthesis and software design of low power.

TEXT BOOKS

1. Abdelatif Belaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995.
2. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer, 1995.

REFERENCES

1. Dimitrios Soudris, C.Pignet, Costas Goutis,"Designing CMOS Circuits for Low Power" Kluwer, 2002.
2. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.

E- RESOURCES

1. https://nptel.ac.in/courses/106/105/106105034/ (Low power VLSI circuits and systems)
2. https://nptel.ac.in/courses/117/101/117101004 /- (Advanced VLSI Design)

21PVP102 **DSP INTEGRATED CIRCUITS** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Analyze the mapping of DSP system design onto hardware.
- Familiarize the fundamental power management concepts of signal processing.
- Synthesize different DSP architectures and processing elements.
- Gain knowledge about uniprocessor in Digital Signal Processing.
- Acquire sound knowledge about Processing elements of IC.

UNIT I: DSP SYSTEM DESIGN **9**

FFT Processor, Design Iteration Scheduling Loop-Folding - Cyclic Scheduling Formulation - Overflow and Quantization - Scheduling Algorithms -FFT Processor- Resource Allocation- Partitioning and Assignment Interpolator- Processor - Memory Assignment Butterfly Processor DCT Processor.

UNIT II: DIGITAL SIGNAL PROCESSOR **9**

DSPs and microprocessors - embodiment, alternatives - memory architecture - addressing- pipelining — on - chip debugging, power consumption and management - clocking - application support - choosing processor architecture trends. Standard digital signal processors - Application specific IC's for DSP.

UNIT III: DSP ARCHITECTURES **9**

Standard DSP and Ideal DSP architectures- Multiprocessors and multicomputer- message based architectures Systolic and Wave front arrays, Shared memory architectures. SHARC and Blackfin processors - Architecture overview, memory management- I/O management- On chip resources- programming considerations, Real time implementations.

UNIT IV: SYNTHESIS OF DSP ARCHITECTURES **9**

Mapping of DSP algorithms onto hardware- Uniprocessor architectures- Isomorphic mapping of SFGs, Implementation based on complex PEs- vector-multiplier based implementations- numerically equivalent implementation, implementation of WDFs, Shared memory architecture with Bit – serial PEs, building the large DSP systems- Single Instruction Computer (SIC).

UNIT V: PROCESSING ELEMENTS OF IC **9**

Bit-Serial Arithmetic- Bit-Serial Two-Port Adaptor 8 S/P Multipliers With Fixed Coefficients Minimum Number Of Basic Operations- Bit-Serial Squares- Serial/Serial Multipliers- Digit-Serial Arithmetic, Cordic Algorithm - Distributed Arithmetic- The Basic Shift-Accumulator - Reducing The Memory Size -Complex Multipliers - Improved Shift Accumulator FFT Processor-Twiddle Factor PE- Control PEs, Address PEs, Base Index Generator, Ram Address PEs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Implement DSP System design.
- Diagnose the design and methodologies in hardware and software design.
- Understand the different architectures in Digital Signal Processor.
- Knowledge about synthesis of DSP architectures.
- Analyze the different processing elements in DSP IC.

TEXT BOOKS

1. B.Venkatramani, M.Bhaskar, "Digital Signal Processors", Tata McGraw-Hill, 2002.
2. John J. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", Pearson Education, 2002.

REFERENCES

1. Keshab Parhi, "VLSI Digital Signal Processing Systems design & Implementation", John Wiley & Sons, 1999.
2. Lars Wanhammer, "DSP Integrated Circuits", Academic press, New York, 1999.

E-RESOURCES

1. http://www.nptelvideos.in/2012/11/digital-integrated-circuits (DSP Integrated Circuits)
2. https://www.digimat.in/nptel/courses/video/108108111/L01 (Introduction to IC)

21PVP103 **PHYSICAL DESIGN OF VLSI CIRCUITS** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Acquire knowledge on fundamentals of VLSI technology.
- Introduce Rules of layout, partitioning, floor planning,
- Understand placement and routing algorithms.
- Impart knowledge on various performance issues in circuit Layout.
- Create an exposure for cell generation and compaction.

UNIT I: INTRODUCTION TO VLSI TECHNOLOGY **9**

Layout Rules - Circuit abstraction Cell generation using programmable logic array transistor chaining - Wein Berger arrays and gate matrices - layout of standard cells gate arrays and sea of gates - Field Programmable Gate Array (FPGA) - layout methodologies Packaging - Computational Complexity - Algorithmic Paradigms.

UNIT II: PLACEMENT USING TOP-DOWN APPROACH **9**

Partitioning: Approximation of Hyper Graphs with Graphs, Kernighan - Lin Heuristic Ratio cut partition with capacity and I/O constraints. Floor planning: Rectangular dual floor planning hierarchical approach - simulated annealing - Floor plan sizing. Placement: Cost function - force directed method - placement by simulated annealing partitioning placement - module placement ona resistive network - regular placement linear placement.

UNIT III: ROUTING USING TOP DOWN APPROACH **9**

Fundamentals: Maze Running - line searching- Steiner trees Global Routing: Sequential Approaches - hierarchical approaches - multi commodity flow based techniques - Randomized Routing - One Step approach - Integer Linear Programming Detailed Routing: Channel Routing - Switch box routing. Routing in FPGA: Array based FPGA - Row based FPGAs.

UNIT IV: PERFORMANCE ISSUES IN CIRCUIT LAYOUT **9**

Delay Models: Gate Delay Models- Models for interconnected Delay- Delay in RC trees. Timing - Driven Placement: Zero Stack Algorithm- Weight based placement - Linear Programming Approach Timing riving Routing: Delay Minimization- Click Skew Problem - Buffered Clock Trees. Minimization: constrained via Minimization unconstrained via Minimization- Other issues in minimization.

UNIT V: SINGLE LAYER ROUTING, CELL GENERATION AND COMPACTION **9**

Planar subset problem (PSP) - Single Layer Global Routing - Single Layer detailed Routing - Wire length and bend minimization technique - Over The Cell (OTC) Routing Multiple chip modules

(MCM) - programmable Logic Arrays - Transistor chaining - Wein Burger Arrays - Gate matrix layout - 1D compaction - 2D compaction.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Explain the layout rules an layout methodologies.
- Implementation of partitioning, floor planning, placement and routing of the cells.
- Analyze routing using top down approach.
- Examine the performance issues in circuit layout.
- Apply 1D and 2D compaction techniques.

TEXT BOOKS

1. Majid Sarrafzadeh, C. K. Wong, "An Introduction to VLSI Physical Design", McGraw Hill, 1996.
2. Andrew B. Kahng, Jens Lienig, Igor L. Markov, JinHu , "VLSI Physical Design: From Graph Partitioning to Timing Closure", Springer Publications, 2011.

REFERENCES

1. Sung Kyu Lim, "Practical Problems in VLSI Physical Design Automation", Springer Publications, 2008.
2. Preas M. Lorenzatti, "Physical Design and Automation of VLSI systems", The Benjamin Cummins Publishers, 1998.

E - RESOURCES

1. https://nptel.ac.in/courses/106/105/106105161/ (VLSI Physical Design)
2. https://nptel.ac.in/courses/117/103/117103125/ (VLSI Design verification and test)

21PVP104 ADVANCED COMPUTER ARCHITECTURE AND PARALLEL PROCESSING **L T P C 3 0 0 3**

OBJECTIVES

The main objective of this course is to:

- Understand the difference between the pipeline and parallel concepts.
- Study the various types of architectures and the importance of scalable architectures.
- Gain the various memories and optimization of memory.
- Learn the concepts of multiprocessors.
- Impart knowledge the concepts of Multi-core architectures.

UNIT I: COMPUTER DESIGN AND PERFORMANCE MEASURES **9**

Fundamentals of Computer Design – Parallel and Scalable Architectures – Multiprocessors – Multi vector and SIMD architectures – Multithreaded architectures – Data-flow architectures -Performance Measures.

UNIT II: PARALLEL PROCESSING, PIPELINING AND ILP **9**

Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling — Dynamic Branch Prediction - Speculation - Multiple Issue Processors - Performance and Efficiency in Advanced Multiple Issue Processors.

UNIT III : MEMORY HIERARCHY DESIGN **9**

Memory Hierarchy - Memory Technology and Optimizations – Cache memory – Optimizations of Cache Performance – Memory Protection and Virtual Memory - Design of Memory Hierarchies.

UNIT IV : MULTIPROCESSORS **9**

Symmetric and distributed shared memory architectures – Cache coherence issues - Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.

UNIT V: MULTI-CORE ARCHITECTURES **9**

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case studies — Intel Multi-core architecture — SUN CMP architecture — IBM cell architecture - hparchitecture.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Address performance evaluation issues, data representation and fixed/flp arithmetic.
- Understand the Concept of Parallel Processing and its applications.
- Analyze and evaluate the organization and functioning of hierarchical memory, cache organizational schemes, and virtual memory.
- Gain in-depth knowledge of memory architecture.
- Learn Software and Hardware multithreading.

TEXT BOOKS

1. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 2001.
2. John L. Hennessey and David A. Patterson, "Computer Architecture — A quantitative approach", Morgan Kaufmann / Elsevier, 4th. edition, 2007.

REFERENCES

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, 7th Edition, 2006.
2. John P. Hayes, "Computer Architecture and Organization", McGraw Hill.

E - RESOURCES

1. https://nptel.ac.in/courses/106/103/106103206/ (Advanced computer architecture)
2. https://nptel.ac.in/courses/106/104/106104024/ (Parallel computer architecture)

21PVP105 VLSI TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study the different properties of material.
- Know various oxide formation techniques.
- Understand plasma assisted etching methods.
- Know the various pattern generation techniques.
- Study the concept of circuit fabrication.

UNIT I : MATERIAL PROPERTIES & CRYSTAL GROWTH 9

Crystal structure-axes &planes, Crystal defects-Point defects &dislocation crystal growth — Bridgman Czochralski techniques & Zone process, Doping in the melt. DIFFUSION & ION IMPLANTATION: Nature of diffusion — interstitial, Substitutional, interstitial Substitutional movements, Diffusion constant, Dissociate process, diffusion equation — D is constant & function, Diffusion systems, problems in Si diffusion, Evaluation techniques Ion implantation: Penetration range , implantation Damage, Annealing Implantation systems.

UNIT II: OXIDATION AND EPITAXY OXIDATION 9

Themal oxidation –Intrinsic, Extrinsic Silicon Glass, Oxide formation ,Kinetic of oxide growth, Oxidation systems ,Faults Anodic oxidation, EPITAXY: Vapour Phase Epitaxy (VPE)- transport, reaction and growth ,Chemistry of growth, Institu etching, selective epitaxy, imperfections, Liquid Phase Epitaxy, LPE system ,Evaluation of epitaxial layers.

UNIT III: ETCHING 9

ETCHING: Wet chemical etching, anisotropic etchants, Etching for non crystalline films, Plasma etching, Plasma assisted etching cleaning.

UNIT IV: LITHOGRAPHY 9

Pattern generation and Masking, Printing and Engraving, Optical E-beam, ion beam X ray, Photo resists, defects.

UNIT V: DEVICE AND CIRCUIT FABRICATION 9

ISOLATION Mesa, Oxide .PN junction isolation ,Self alignment, local oxidation, Planarisation, Metallization and packaging. Circuits – N,P and CMOS transistors, memory devices ,BJT circuits – buried layers ,PNP and NPN transistors, Diodes ,Resistors, Capacitors.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand material properties and crystal growth.
- Knowledge of oxidation techniques.
- Analyze various etching techniques.
- Study printing and engraving methods.
- Understand various device fabrication concepts.

TEXT BOOKS

1. Donald Neamen, Dhrupes Biswas , "Semiconductor Physics and Devices" McGraw Hill, New York , 4th Edition, 2017.
2. Massimo Rudan, "Physics of Semiconductor devices"Springer ,2nd Edition, 2017.

REFERENCES

1. Sze S M, "VLSI Technology "McGraw Hill ,New York , 2nd Edition,2017.
2. Chang SY and Sze S M, "VLSI Technology"McGraw Hill ,New York ,2007.

E- RESOURCES

1. https://nptel.ac.in/courses/117/106/117106093/ (VLSI Technology)
2. https://nptel.ac.in/courses/108/101/108101089/ (Fabrication of VLSI Circuits using the MOS Technology)

PROFESSIONAL ELECTIVE II

21PVP201 VLSI SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce techniques for altering the existing DSP structures to suit VLSI implementations.
- Understand the algorithmic reduction techniques.
- Know the fast convolution, IIR filters.
- Create an exposure for various Bit-level Arithmetic architectures.
- Impart knowledge on various algorithmic strength reduction techniques.

UNIT I: PIPELINING AND PARALLEL PROCESSING OF DIGITAL FILTERS 9

Introduction to DSP systems — Typical DSP algorithms, Data flow and Dependence graphs —critical path, Loop bound, iteration bound, longest path matrix algorithm, Pipelining and Parallel processing of FIR filters, Pipelining and Parallel processing for low power.

UNIT II: ALGORITHMIC STRENGTH REDUCTION TECHNIQUE I 9

Retiming — definitions and properties, Unfolding — an algorithm for unfolding, properties of unfolding, sample period reduction and parallel processing application, Algorithmic strength reduction in filters and transforms – 2-parallel FIR filter, 2-parallel fast FIR filter, DCT architecture, rank-order filters, Odd-Even merge-sort architecture, parallel rank-order filters.

UNIT III: ALGORITHIMIC STRENGTH REDUCTION -II 9

Fast convolution — Cook-Toom algorithm, modified Cook-Toom algorithm, Pipelined and parallel recursive filters — Look-Ahead pipelining in first-order IIR filters, Look-Ahead pipelining with powerof-2 decomposition, Clustered look-ahead pipelining, Parallel processing of IIR filters, combined pipelining and parallel processing of IIR filters.

UNIT IV: BIT-LEVEL ARITHMETIC ARCHITECTURES 9

Bit-level arithmetic architectures — parallel multipliers with sign extension, parallel carry-ripple and carry-save multipliers, Design of Lyon‟s bit-serial multipliers using Horner‟s rule, bit-serial FIR filter, CSD representation, CSD multiplication using Horner‟s rule for precision improvement, Distributed Arithmetic fundamentals and FIR filters.

UNIT V: NUMERICAL STRENGTH REDUCTION, WAVE AND ASYNCHRONOUS PIPELINING **9**

Numerical strength reduction – subexpression elimination, multiple constant multiplication, iterative matching, synchronous pipelining and clocking styles, clock skew in edge-triggered single phase clocking, two-phase clocking, wave pipelining. Asynchronous pipelining bundled data versus dual rail protocol.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Know the pipelining and parallel processing of digital filters.
- Apply the concept of pipelining, retiming and parallel processing in design of high-speed low power applications.
- Apply unfolding, folding and fast convolution in the design of VLSI architecture
- Built the bit-level arithmetic architectures..
- Employ the algorithmic strength reduction techniques to VLSI implementation of filters.

TEXT BOOKS

1. Keshab K. Parhi, "VLSI Digital Signal Processing Systems, Design and Implementation", Wiley, Interscience, 2007.
2. U. Meyer – Baese, " Digital Signal Processing with Field Programmable Gate Arrays", Springer, 2nd Edition, 2004.

REFERENCES

1. Doebelin, E.O., Measurement Systems - Application and Design, Tata McGraw Hill publishing company, 2005.
2. R.K Rajput, Electrical Measurements and Measuring Instruments, S.Chand & Company LTD, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/108/105/108105157/(VLSI Signal Processing)
2. https://onlinecourses.nptel.ac.in/noc20_ee44/preview(VLSI Signal Processing)

21PVP202 **RECONFIGURABLE ARCHITECTURES** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand concept of reconfigurable computing systems.
- Acquire knowledge on fundamentals of reconfigurable architectures.
- Study flexibility on rout ability.
- Classification of FPGA based on the basic blocks, application specific design styles.
- Routing of FPGA, Technology independent optimization, high level synthesis and RCS for specific applications.

UNIT I: INTRODUCTION **9**

Domain-specific processors, Application specific processors, Reconfigurable Computing Systems – Evolution of reconfigurable systems – Characteristics of RCS advantages and issues. Fundamental concepts & Design steps –classification of reconfigurable architecture-fine, coarse grain & hybrid architectures – Examples.

UNIT II: FPGA TECHNOLOGIES & ARCHITECTURE **9**

Technology trends- Programming technology- SRAM programmed FPGAs, antifuse programmed FPGAs, erasable programmable logic devices. Alternative FPGA architectures: Mux Vs LUT based logic blocks – CLB Vs LAB Vs Slices- Fast carry chains- Embedded RAMs- FPGA Vs ASIC design styles.

UNIT III: ROUTING FOR FPGAS **9**

General Strategy for routing in FPGAs- routing for row-based FPGAs — segmented channel routing, definitions- Algorithm for I segment and K segment routing — Routing for symmetrical FPGAs, Flexibility of FPGA Routing Architectures: FPGA architectural flexibility on Routability- Effect of switch block flexibility on routability - Tradeoffs in flexibility of S and C blocks.

UNIT IV: HIGH LEVEL DESIGN **9**

FPGA Design style: Technology independent optimization- technology mapping- Placement. High level synthesis of reconfigurable hardware, high- level languages, Design tools: Simulation (cycle based, event driven based) — Synthesis (logic/HDL vs physically aware) — timing analysis (static vs dynamic)-verification physical design tools.

UNIT V: APPLICATION DEVELOPMENT WITH FPGAS **9**

Case Studies of FPGA Applications–System on a Programmable Chip (SoPC) Designs.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Students will be able to demonstrate ability to report on the reconfigurable architecture and FPGA fundamentals.
- Compare FPGA routing architectures.
- Discuss routing for FPGA .
- Explain high level synthesis.
- Understand FPGA applications.

TEXT BOOKS

1. Christophe Bobda, "Introduction to Reconfigurable Computing –Architectures, Algorithms and Applications", Springer, 2010.
2. Clive "Max" Maxfield, "The Design Warrior‟s Guide to FPGAs: Devices, Tools And Flows", Newnes, Elsevier, 2006.

REFERENCES

1. Jorgen Staunstrup, Wayne Wlf, "Hardware/Software Co- Design: Principles and practice", Kluwer Academic Pub, 1997.
2. Reconfigurable Computing: The Theory and Practice of FPGA-Based Computation, edited by Scott Hauck and Andre De Hon, Elsevier, Inc. (Morgan Kaufmann Publishers), Amsterdam, 2008.

E - RESOURCES

1. https://nptel.ac.in/courses/108/105/108105118/(Architectural Design of Digital Integrated Circuits)
2. https://nptel.ac.in/courses/117/108/117108040/(Digital System Design with PLDs and FPGAs)

21PVP203	DESIGN OF ANALOG FILTERS AND SIGNAL CONDITIONING CIRCUITS	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the concepts of filter topologies.
- Realize the functions of integrator.
- Create an exposure for switched capacitor filter realization.
- Elaborate discussion about signal conditioning techniques.
- Impart knowledge on signal conditioning circuits.

UNIT I: FILTER TOPOLOGIES **9**

The Bilinear Transfer Function - Active RC Implementation, Transconductor-C Implementation, Switched Capacitor Implementation, Biquadratic Transfer Function, Active RC implementation, Switched capacitor implementation, High Q, Q peaking and instability, Transconductor-C Implementation, the Digital Biquad.

UNIT II: INTEGRATOR REALIZATION **9**

Lowpass Filters, Active RC Integrators – Effect of finite Op-Amp Gain Bandwidth Product, Active RC SNR, gm-C Integrators, Discrete Time Integrators.

UNIT III: SWITCHED CAPACITOR FILTER REALIZATION **9**

Switched capacitor Technique, Biquadratic SC Filters, SC N-path filters, Finite gain and bandwidth effects, Layout consideration, Noise in SC Filters.

UNIT IV: SIGNAL CONDITIONING TECHNIQUES **9**

Interference types and reduction, Signal circuit grounding, Shield grounding, Signal conditioners for capacitive sensors, Noise and Drift in Resistors, Layout Techniques.

UNIT V: SIGNAL CONDITIONING CIRCUITS **9**

Isolation Amplifiers, Chopper and Low Drift Amplifiers, Electrometer and Transimpedance Amplifiers, Charge Amplifiers, Noise in Amplifiers.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Analyze the concepts filter topologies.
- Understand the integrator realization.
- Study the concept of switched capacitor filter realization.
- Understand the concepts of signal conditioning techniques.
- Know the signal conditioning circuits.

TEXT BOOKS

1. Ramson Pallas-Areny, John G. Webster "Sensors and Signal Conditioning", A Wiley Interscience Publication, John Wiley & Sons INC, 2001.
2. R. Jacob Baker, "CMOS Mixed-Signal Circuit Design", John Wiley & Sons, 2008.

REFERENCES

1. Schauman, Xiao and Van Valkenburg, "Design of Analog Filters", OxUniversity Press,2009.
2. Hayes and Horowitz, Learning the Art of Electronics: A Hands-On Lab Course, 2016.

E-RESOURCES

1. https://nptel.ac.in/courses/117/108/117108107/(Analog Circuits and Systems)
2. https://nptel.ac.in/courses/108/105/108105064/(Industrial Instrumentation)

21PVP204 **SYSTEM ON CHIP DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand CMOS scaling, integration.
- Know the various operating principle of ASIC, CSIC, RISC applications.
- Elaborate discussion NSIC, ADL Languages.
- Impart knowledge SOC related modeling.
- Create an exposure on Low power SOC and Digital system.

UNIT I: MOTIVATION FOR SOC DESIGN **9**

Review of Moore's law and CMOS scaling, benefits of system-on-chip integration in terms of cost, power, and performance, Comparison of System-on-Board, System-on-Chip, and System-in-Package, Typical goals in SOC design — cost reduction, power reduction, design effort reduction, performance maximization.

UNIT II: ASIC **9**

Overview of ASIC types, Design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application specific Instruction Processor(ASIP)concepts.

UNIT III: NISC **9**

No instruction set computer(NISC) Control words methodology, NISC Application and Advantages, Architecture Description Languages(ADL) for design and verification ofApplication specific Instruction set Processors(ASIP), No-Instruction-set computer (NISC) - design flow, modeling NISC architectures and systems, use of generic netlist representation.

UNIT IV: SIMULATION **9**

Different simulation modes, behavioral, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SOC related modeling of data path design and control logic, Minimization of interconnect impact, clock tree issues.

UNIT V: LOW POWER SOC DESIGN/DIGITAL SYSTEM **9**

Design synergy, Low power system perspective-power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling(DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Compare SoB, SoC and SiP for electronic product in terms of size, cost, performance and reliability.
- Analyze different approaches for solving architectural issues of SOC design.
- Discuss NISC and use of ADL.
- Recognize different simulation models and modeling of reconfigurable systems.
- Appraise low power SOC design.

TEXT BOOKS

1. Sudeep Pasricha and Nikil Dutt, "On-Chip Communication Architectures: System on Chip Interconnect", Morgan Kaufmann Publishers, 2008.
2. Rao R. Tummala, Madhavan Swaminathan, "Introduction to system on package SOP – Miniaturization of the Entire System", McGraw-Hill, 2008.

REFERENCES

1. Hubert Kaselin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. Michael J Flynn and Wayne Luk, "Computer system design: System-on-chip", Wiley Publications, 2011.

E - RESOURCES

1. https://nptel.ac.in/courses/108106158 (Digital IC Design)
2. https://nptel.ac.in/courses/108/102/108102045/ (Embedded system)

21PVP205 **SECURITY SOLUTIONS IN VLSI** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study the different kinds of threats to information security.
- Know the various techniques for data encryption.
- Formulate case study based on VLSI for security threats.
- Design and implement the various cryptography algorithms in VLSI.
- Understand the concepts of crypto chip design.

UNIT I: BASIC CONCEPTS **9**

Information system reviewed, LAN, MAN, WAN, Information flow, Security mechanism in OS, Targets: Hardware, Software, Data communication procedures. Threats to Security: Physical security, Biometric systems, monitoring controls, Data security, systems, security, Computer System security, communication security.

UNIT II: ENCRYPTION TECHNIQUES **9**

Conventional techniques, Modern techniques, DES, DES chaining+, Triple DES, RSA algorithm, Key management. Message Authentication and Hash Algorithm: Authentication requirements and functions secure Hash Algorithm, NDS message digest algorithm, digital signatures, Directory authentication service.

UNIT III: FIREWALLS AND CYBER LAWS **9**

Firewalls, Design Principles, Trusted systems, IT act and cyber laws, Virtual private network.

UNIT IV: FUTURE THREATS TO NETWORK **9**

Recent attacks on networks, VLSI Based Case study.

UNIT V: CRYPTO CHIP DESIGN **9**

VLSI Implementation of AES algorithm. Implementation of DES, IDEA AES algorithm, Development of digital signature chip using RSA algorithm.

TOTAL : 45 PERIODS

OUTCOMES

After completing this course, students should demonstrate competency in the following skills:

- Understand Information system.
- Knowledge of data encryption.
- Study the firewalls and cyber laws.
- Understand future threats to network.
- Design concepts of crypto chip design.

TEXT BOOKS

1. William Stalling "Cryptography and Network Security" Pearson Education, 2005.
2. Charels P. Pfleeger "Security in Computing" Prentice Hall, 2006.

REFERENCES

1. Jeff Crume "Inside Internet Security" Addison Wesley, 2000.
2. Charlie Kaufman, "Network Security Private Communication in Public World" 2nd edition, Prentice Hall of India New Delhi, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105162/(Crptography and Network Security)
2. https://nptel.ac.in/courses/106/106/106106178/(Information security)

PROFESSIONAL ELECTIVE III

21PVP206 DESIGN OF SEMICONDUCTOR MEMORIES L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study the architectures for SRAM and DRAM.
- Know about various non-volatile memories.
- Study the fault modeling and testing of memories for fault detection.
- Learn the radiation hardening process and issues for memory.
- Evaluate the fault modeling and testing procedures for memory circuit.

UNIT I: RANDOM ACCESS MEMORY TECHNOLOGIES 9

Static Random Access Memories (SRAMs):SRAM Cell Structures – MOS SRAM Architecture – MOS SRAM Cell and Peripheral Circuit Operation – Bipolar SRAM Technologies – Silicon On Insulator (SOI) Technology – Advanced SRAM Architectures and Technologies – Application Specific SRAMs. Dynamic Random Access Memories (DRAMs): DRAM Technology Development – CMOS DRAMs – DRAMs Cell Theory and Advanced Cell Structures – BiCMOS– DRAMs – soft error failures in DRAMs – Advanced DRAM Designs and Architecture –Application, Specific DRAMs.

UNIT II: NON VOLATILE MEMORIES 9

Masked Read–Only Memories (ROMs) – High Density ROMs – Programmable Read –Only Memories (PROMs) – Bipolar PROMs – CMOS PROMs – Erasable (UV) – Programmable Read– Only Memories (EPROMs) – Floating – Gate EPROM Cell–One Time Programmable (OTP) EPROM – Electrically Erasable PROMs (EEPROMs) –EEPROM Technology and Architecture – Non volatile SRAM –Flash Memories(EPROMs or EEPROM)-Advanced Flash Memory Architecture.

UNIT III: MEMORY FAULT MODELLING & TESTING AND MEMORY DESIGN FOR TESTABILITY AND FAULT TOLERANCE 9

RAM Fault Modeling, Electrical Testing, Pseudo Random Testing-Megabit DRAM Testing Nonvolatile Memory Modeling and Testing-IDDQ Fault Modeling and Testing Application Specific Memory Testing. General Design for Testability Techniques – Ad Hoc Design Techniques, Structured Design Techniques – RAM Built-In Self – Test (BIST).

UNIT IV: RELIABILITY AND RADIATION EFFECTS 9

General Reliability Issues-RAM Failure Modes and Mechanism-Nonvolatile Memory Reliability, Reliability Modeling and Failure Rate Prediction-Design for Reliability- Reliability Test Structures

Reliability creening and Qualification. Radiation Effects-Single Event Phenomenon (SEP)- Radiation Hardening Techniques Radiation Hardening Process and Design Issues-Radiation Hardened Memory Characteristics-Radiation Hardness Assurance and Testing - Radiation Dosimetry-Water Level Radiation Testing and Test Structures**.**

UNIT V: PACKAGING TECHNOLOGIES **9**

Random Access Memories (MRAMs)-Experimental Memory Devices. Memory Hybrids and MCMs (2D)-Memory Stacks and MCMs (3D)-Memory MCM Testing and Reliability Issues- Memory Cards High Density Memory Packaging Future Directions.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Synthesize Static and Dynamic Memory structures.
- Analysis the different RAM and ROM architecture and interconnects.
- Design and implement various fault modeling techniques in memory design.
- Decide the type of memory for a specific application.
- Analyze the modeling for memory fault and testing.

TEXT BOOKS

1. Ashok K.Sharma, " Semiconductor Memories Technology, Testing and Reliability", PrenticeHall of India Private Limited, New Delhi, 1997.
2. Tegze P.Haraszti, "CMOS Memory Circuits", Kluwer Academic publishers, 2001.

REFERENCES

1. Betty Prince, "Emerging Memories: Technologies and Trends", Kluwer Academic publishers, 2002.
2. Ivan Sutherland Bob Sproull, David Harris, "Logical Efforts, Designing Fast CMOSCircuits", Kluwr Academic Press, 1999.

E- RESOURCES

1. https://www.digimat.in/nptel/courses/video/108108122/L01l (Semiconductors)
2. https://nptel.ac.in/courses/108/108/108108112/ (Semiconductor memory)

21PVP207 **SCRIPTING LANGUAGES FOR VLSI** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Study scripting languages.
- Understand security issues.
- Learn concept of TCL phenomena.
- Understand the concept of interfacing.
- Able to write java script core language.

UNIT I: INTRODUCTION TO SCRIPTING AND PERL **9**

Characteristics of scripting languages, Introduction to PERL, Names and values, Variables and assignment, Scalar expressions, Control structures, Built-in functions, Collections of Data, Working with arrays, Lists and hashes, Simple input and output, Strings, Patterns and regular expressions, Subroutines, Scripts with arguments.

UNIT II : ADVANCED PERL **9**

Finer points of Looping, Subroutines, Using Pack and Unpack, Working with files, Navigating the file system, Type globs, Eval, References, Data structures, Packages, Libraries and modules, Objects, Objects and modules in action, Tied variables, Interfacing to the operating systems, Security issues.

UNIT III: TCL **9**

The TCL phenomena, Philosophy, Structure, Syntax, Parser, Variables and data in TCL, Control flow, Data structures, Simple input/output, Procedures, Working with Strings, Patterns, Files and Pipes, Example code.

UNIT IV : ADVANCED TCL **9**

The eval, source, exec and up-level commands, Libraries and packages, Namespaces, Trapping errors, Event-driven programs, Making applications 'Internet-aware', 'Nuts-and-bolts' internet programming, Security issues, running un trusted code, The C interface.

UNIT V: TK AND JAVA SCRIPT **9**

Visual tool kits, Fundamental concepts of TK, TK by example, Events and bindings, Geometry managers, PERL-TK. JavaScript – Object models, Design Philosophy, Versions of JavaScript, The Java Script core language, Basic concepts of Python. Object Oriented Programming Concepts (Qualitative Concepts Only): Objects, Classes, Encapsulation, Data Hierarchy.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Analyze Scripting languages with arguments.
- Understand the concept of PERL.
- Know the TCL structure, procedures.
- Explain advanced TCL.
- Discuss TK and Java script.

TEXT BOOKS

1. Brent Welch,"Practical Programming in Tcl and Tk",4th Edition, 2003.
2. David Barron, "The World of Scripting Languages", Wiley Publications, 2000.

REFERENCES

1. Guido van Rossum, and Fred L. Drake ," Python Tutoria"l, Jr., editor, Release 2.6.4.
2. Randal L. Schwartz, "Learning PERL", 6th Edition, O"Reilly.

E-RESOURCES

1. https://nptel.ac.in/courses/117/106/117106113/ (Linux Programming & Scripting)
2. http://nptelvideos.com/video.php?id=727(Computer Science)

21PVP208 **NETWORKS ON CHIP** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the concept of network - on – chip.
- Learn router architecture designs.
- Study fault tolerance network - on – chip.
- Impart knowledge test and fault tolerance of NOC.
- Create an exposure on three-dimensional integration of network-on-chip.

UNIT I: INTRODUCTION TO NOC **9**

Introduction to NoC — OSI layer rules in NoC - Interconnection Networks in Network-on- Chip Network Topologies - Switching Techniques - Routing Strategies - Flow Control Protocol Quality-of-Service Support.

UNIT II: ARCHITECTURE DESIGN **9**

Switching Techniques and Packet Format - Asynchronous FIFO Design -GALS Style of Communication - Wormhole Router Architecture Design - VC Router Architecture Design - Adaptive Router Architecture Design.

UNIT III: ROUTING ALGORITHM **9**

Packet routing-Qos, congestion control and flow control – router design – network link design — Efficient and Deadlock-Free Tree-Based Multicast Routing Methods - Path-Based Multicast Routing for 2D and 3D Mesh Networks- Fault-Tolerant Routing Algorithms - Reliable and Adaptive Routing Algorithms.

UNIT IV: TEST AND FAULT TOLERANCE OF NOC **9**

Design-Security in Networks-on-Chips-Formal Verification of Communications in Networks-on Chips-Test and Fault Tolerance for Networks-on-Chip Infrastructures-Monitoring Services for Networks-on-Chips.

UNIT V: THREE-DIMENSIONAL INTEGRATION OF NETWORK-ON-CHIP **9**

Three - Dimensional Networks-on-Chips Architectures. – A Novel Dimensionally-Decomposed Router for On-Chip Communication in 3D Architectures - Resource Allocation for QoS On-Chip Communication – Networks-on-Chip Protocols-On-Chip Processor Traffic Modeling for Networks- on-Chip.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Know the NOC and switching techniques.
- Compare different architecture design.
- Discuss different routing algorithms.
- Recognize test and fault tolerance of NOC.
- Appraise three-dimensional integration of network-on-chip.

TEXT BOOKS

1. ChrysostomosNicopoulos, Vijaykrishnan Narayanan, Chita R.Das, "Networks-on - Chip Architectures Holistic Design Exploration", Springer.
2. Fayezgebali, Haythamelmiligi, HqhahedWatheq E1-Kharashi "Networks-on-Chips theory and practice CRC press.

REFERENCES

1. Konstantinos Tatas and Kostas Siozios "Designing 2D and 3D Network-on-Chip Architectures" 2013.
2. Palesi, Maurizio, Daneshtalab, Masoud "Routing Algorithms in Networks-on-Chip" 2014.

E - RESOURCES

1. https://nptel.ac.in/courses/108/105/108105118/(Architectural Design of Digital integrated circuits)
2. https://nptel.ac.in/courses/106/105/106105183/(Computer Networks and Internet Protocol)

21PVP209 SIGNAL INTEGRITY FOR HIGH SPEED DESIGN L T P C
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Identify sources affecting the speed of digital circuits.
- Impart knowledge multi-conductor transmission lines and cross-talk.
- Understand the analysis of non-ideal effects.
- Introduce methods of power considerations and system design..
- Study the clock distribution and clock oscillators..

UNIT I: SIGNAL PROPAGATION ON TRANSMISSION LINES 9

Transmission line equations, wave solution, wave vs. circuits, initial wave, delay time, Characteristic impedance, wave propagation, reflection, and bounce diagrams Reactive terminations — L, C, static field maps of micro strip and strip line cross-sections, per unit length parameters, PCB layer stackups and layer/Cu thicknesses, cross-sectional analysis tools, Zo and Td equations for microstrip and stripline Reflection and terminations for logic gates, fan-out, logic switching , input impedance into a transmission-line section, reflection coefficient, skin-effect, dispersion.

UNIT II: MULTI-CONDUCTOR TRANSMISSION LINES AND CROSS-TALK 9

Multi-conductor transmission-lines, coupling physics, per unit length parameters ,Near and far-end cross-talk, minimizing cross-talk (stripline and microstrip) Differential signalling, termination, balanced circuits ,S-parameters, Lossy and Lossles models.

UNIT III: NON-IDEAL EFFECTS 9

Non-ideal signal return paths – gaps, BGA fields, via transitions , Parasitic inductance and capacitance, Transmission line losses – Rs, tanδ, routing parasitic, Common-mode current, differential-mode current, Connectors.

UNIT IV: POWER CONSIDERATIONS AND SYSTEM DESIGN 9

SSN/SSO, DC power bus design, layer stackup, SMT decoupling, Logic families, power consumption, and system power delivery, Logic families and speed Package types and parasitic, SPICE, IBIS models ,Bit streams, PRBS and filtering functions of link-path components, Eye diagrams, jitter, inter-symbol interference Bit-error rate, Timing analysis.

UNIT V: CLOCK DISTRIBUTION AND CLOCK OSCILLATORS 9

Timing margin, Clock slew, low impedance drivers, terminations, Delay Adjustments, canceling parasitic capacitance, Clock jitter.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Ability to identify sources affecting the speed of digital circuits.
- Understand the multi-conductor transmission lines and cross-talk.
- Analyze the non-ideal signal effects.
- Study the performance characteristics of power considerations and system design.
- Know the timing margin and clock jitter.

TEXT BOOKS

1. Douglas Brooks, "Signal Integrity Issues and Printed Circuit Board Design" Prentice Hall PTR, 2003.
2. Eric Bogatin, "Signal Integrity – Simplified", Prentice Hall PTR, 2003.

REFERENCES

1. H. W. Johnson and M. Graham, High-Speed Digital Design: A Handbook of Black Magic, Prentice Hall, 1993.
2. S. Hall, G. Hall, and J. McCall, High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices, Wiley – Inter science, 2000.

E-RESOURCES

1. https://nptel.ac.in/courses/108/106/108106157/ (Transmission lines and electromagnetic waves)
2. https:// nptel.ac.in/courses/117/101/117101056/ (Introduction to EM waves and various techniques of communication)

21PVP210	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand Programmable Digital Signal Processor basics.
- Learn the TMS320C5X processor.
- Advanced DSP C6x architectures and some applications.
- Programmable ADSP's Architecture, addressing modes and instruction sets.
- Programming for signal processing applications.

UNIT I: FUNDAMENTALS OF PROGRAMMABLE DSPs **9**

Multiplier and Multiplier accumulator – Modified Bus Structures and Memory access in PDSPs – Multiple access memory – Multi-port memory – VLIW architecture- Pipelining – Special Addressingmodes in P-DSPs – On chip Peripherals.

UNIT II: TMS320C5X PROCESSOR **9**

Architecture – Assembly language syntax - Addressing modes – Assembly language Instructions - Pipeline structure, Operation — Block Diagram of DSP starter kit — Application Programs for processing real time signals.

UNIT III: TMS320C6X PROCESSOR **9**

Architecture of the C6x Processor - Instruction Set - DSP Development System: Introduction – DSP Starter Kit Support Tools- Code Composer Studio - Support Files - Programming Examplesto Test the DSK Tools – Application Programs for processing real time signals.

UNIT IV: ADSP PROCESSORS **9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors- Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V: ADVANCED PROCESSORS **9**

Architecture of TMS320C54X: Pipe line operation, Code Composer studio – Architecture of TMS320C6X - Architecture of Motorola DSP563XX – Comparison of the features of DSP family processors.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Become Digital Signal Processor specialized engineer.
- DSP TMS320C5X based System Developer.
- Analyze the concepts of C6x Digital Signal Processors.
- Discuss, compare and select the suitable Advanced DSP Processors for real-time signal processing applications.
- Demonstrate their ability to program the DSP processor for signal processing applications.

TEXT BOOKS

1. Avtar Singh and S. Srinivasan, "Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx", cengage Learning India Private Limited, Delhi 2012.
2. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications" – Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

REFERENCES

1. Rulph Chassaing, Digital Signal Processing and Applications with the C6713 and C6416 DSK, A John Wiley & Sons, Inc., Publication, 2005.
2. User guides Texas Instrumentation, Analog Devices, Motorola.

E - RESOURCES

1. https://nptel.ac.in/courses/117/102/117102060/ (Digital Signal Processing)
2. https://nptel.ac.in/courses/108/106/108106149/ (Mapping Signal Processing Algorithms to Architectures)

PROFESSIONAL ELECTIVE IV

21PVP301 **MIXED SIGNAL VLSI DESIGN** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the concepts of switched capacitor circuits.
- Study the concepts of phase lock loops.
- Introduce the data converter fundamentals.
- Know the A/D converters.
- Impart knowledge of sampling converters.

UNIT I: SWITCHED CAPACITOR CIRCUITS 9+3

Introduction to Switched Capacitor circuits- basic building blocks, Operation and Analysis, Non-ideal effects in switched capacitor circuits, Switched capacitor integrators first order filters, Switch sharing, Biquad filters.

UNIT II: PHASED LOCK LOOP (PLL) 9+3

Basic PLL topology, Dynamics of simple PLL, Charge pump PLLs-Lock acquisition, Phase/Frequency detector and charge pump, Basic charge pump PLL, Non-ideal effects in PLLs- PFD/CP non-idealities, Jitter in PLLs, Delay locked loops, applications.

UNIT III: DATA CONVERTER FUNDAMENTALS 9+3

DC and dynamic specifications, Quantization noise, Nyquist rate D/A converters- Decoder based Converters, Binary-Scaled converters, Thermometer-code converters, Hybrid converters.

UNIT IV: NYQUIST RATE A/D CONVERTERS 9+3

Successive approximation converters, Flash converter, Two-step A/D converters, Interpolating A/D Converters, Folding A/D converters, Pipelined A/D converters, Time-Interleaved Converters.

UNIT V: OVERSAMPLING CONVERTERS 9+3

Noise shaping modulators, Decimating filters and interpolating filters, Higher order modulators, Delta sigma modulators with multi bit quantizers, Delta sigma D/A.

TOTAL: 45+15=60 PERIODS

OUTCOMES

The students can:

- Demonstrate in-depth knowledge in Switched Capacitor Circuits.
- Analyze the concepts of Phased Lock Loop.
- Apply appropriate techniques, resources and tools to engineering activities in developmentof Data Converters.
- Solve engineering problems with wide range of solutions to increase Data Rate of ADC and DAC.
- Realize nose shaping modulators.

TEXT BOOKS

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", TMH Edition, 2002.
2. Philip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, International 2nd Edition/Indian Edition, 2010.

REFERENCES

1. Rudy Van De Plassche, "CMOS Integrated Analog-to-Digital and Digital-to Analog converters", Kluwer Academic Publishers, 2003.
2. Richard Schreier, "Understanding Delta-Sigma Data converters", Wiley Inter science, 2005.

E - RESOURCES

1. https://nptel.ac.in/courses/117/106/117106034/(VLSI Data Conversion Circuits)
2. https://nptel.ac.in/courses/108/106/108106084/(Analog Circuits)

21PVP302 **EMBEDDED SYSTEM DESIGN** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Study general embedded system and design methodology.
- Learn ASIPs and UART.
- Understand bus structures.
- Study state machine and concurrent process models.
- Impart knowledge on embedded software development tools and RTOS.

UNIT I: EMBEDDED SYSTEM OVERVIEW **9+3**

Embedded System Overview, Design Challenges — Optimizing Design Metrics, Design Methodology, RT- Level Combinational and Sequential Components, Optimizing Custom Single-Purpose Processors.

UNIT II: GENERAL AND SINGLE PURPOSE PROCESSOR **9+3**

Basic Architecture, Pipelining, Superscalar and VLIW architectures, Programmer‟s view, Development Environment, Application-Specific Instruction-Set Processors (ASIPs) Microcontrollers, Timers, Counters and watchdog Timer, UART, LCD Controllers and Analog-to- Digital Converters, Memory Concepts.

UNIT III: BUS STRUCTURES **9+3**

Basic Protocol Concepts, Microprocessor Interfacing – I/O Addressing, Port and Bus-Based I/O, Arbitration, Serial Protocols, I2C, CAN and USB, Parallel Protocols — PCI and ARM Bus, Wireless Protocols — IrDA, Bluetooth, IEEE 802.11.

UNIT IV: STATE MACHINE AND CONCURRENT PROCESS MODELS **9+3**

Basic State Machine Model, Finite-State Machine with Datapath Model, Capturing State Machinein Sequential Programming Language, Program-State Machine Model, Concurrent Process Model, Communication among Processes, Synchronization among processes, Dataflow Model, Real-time Systems, Automation: Synthesis, Verification : Hardware/Software Co-Simulation, Reuse: Intellectual Property Cores, Design Process Models.

UNIT V: EMBEDDED SOFTWARE DEVELOPMENT TOOLS AND RTOS **9+3**

Compilation Process – Libraries – Porting kernels – C extensions for embedded systems – emulation and debugging techniques – RTOS – System design using RTOS.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Study the Embedded System Overview.
- Understand general and single purpose processor.
- Explain different protocols.
- Discuss state machine and design process models.
- Outline embedded software development tools and RTOS.

TEXT BOOKS

1. Bruce Powel Douglas, "Real time UML, 2nd edition: Developing efficient objects for embedded systems", 3rd Edition 1999, Pearson Education.
2. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education, 2002.

REFERENCES

1. Frank Vahid and Tony Gwargie, "Embedded System Design", John Wiley & sons,2002.
2. Steve Heath, "Embedded System Design", Elsevier, 2nd Edition, 2004.

E - RESOURCES

1. https://nptel.ac.in/courses/108/102/108102169/(Introduction to Embedded SystemDesign)
2. https://nptel.ac.in/courses/106/105/106105159/(Embedded Systems Design)

21PVP303 SOFT COMPUTING AND OPTIMIZATION TECHNIQUES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Familiarizes with the design of various neural networks.
- Understand the concept of fuzzy logic.
- Gain insight onto Neuro Fuzzy modeling and control.
- Knowledge in conventional optimization techniques.
- Understand the various evolutionary optimization techniques.

UNIT I: NEURAL NETWORKS 9+3

Machine Learning using Neural Network, Learning algorithms, Supervised Learning Neural Networks – Feed Forward Networks, Radial Basis Function, Unsupervised Learning Neural Networks – Self Organizing map , Adaptive Resonance Architectures, Hopfield network.

UNIT II: FUZZY LOGIC 9+3

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.

UNIT III: NEURO-FUZZY LOGIC MODELING 9+3

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case Studies**.**

UNIT IV: CONVENTIONAL OPTIMIZATION TECHNIQUES 9+3

Introduction to optimization techniques, Statement of an optimization problem, classification, Unconstrained optimization-gradient search method-Gradient of a function, steepest gradient-conjugate gradient, Newton‟s Method, Marquardt Method, Constrained optimization –sequential linearprogramming, Interior penalty function method, external penalty function method.

UNIT V: EVOLUTIONARY OPTIMIZATION TECHNIQUES 9+3

Genetic algorithm - working principle, Basic operators and Terminologies, Building block hypothesis, Travelling Salesman Problem, Particle swam optimization, Ant colony optimization.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Implement machine learning through Neural networks.
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.
- Use the optimization techniques to solve the real world problems.
- Learn various Soft computing frameworks.

TEXT BOOKS

1. David E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", Addison wesley, 2009.
2. Singiresu S. Rao, "Engineering optimization Theory and practice", John Wiley & sons, inc, 4th Edition, 2009.

REFERENCES

1. Venkata Rao, Vimal J. Savsani, Mechanical Design Optimization Using Advanced OptimizationTechniques, springer 2012.
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall of India, 2003.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105173/(Introduction to Soft Computing)
2. https://nptel.ac.in/courses/117/105/117105084/(Neural Networks and Applications)

21PVP304 **VLSI FOR BIOMEDICAL SYSTEMS** **LT P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Introduce the biomedical sensing.
- Know the Wireless implantable devices.
- Analyze the CMOS circuits for wireless medical applications.
- Introduce solid state interface and neural stimulation.
- Understand neuron models and CMOS systems.

UNIT I: BIO MEDICAL SENSING **9+3**

Neuro chemical sensing-Neuro potential sensing- RF telemetry and Power harvesting in Implant devices- Multimodal Electrical and Chemical Sensing-Prosthesis exterior body unit and wireless link-Body implantable unit- system prototype.

UNIT II: CMOS CIRCUITS FOR BIOMEDICAL IMPLANTABLE DEVICES **9+3**

Inductive link to deliver power implants- Data transmission through inductive links- Energy and Bandwidth issues in multi-channel recording- Strain Measurement and motivation for self-power sensing-Piezoelectric transduction and power delivery- Micro watt piezo powered electric circuits-Design and calibration of floating gate sensor Array.

UNIT III: CMOS CIRCUITS FOR WIRELESS MEDICAL APPLICATIONS **9+3**

Spectrum usage for medical Use- integrated transmitter and receiver architectures- radio architecture selection- Low noise amplifiers- Mixers-Poly phase filters -Power Amplifiers and PLL.

UNIT IV: SOLID STATE INTERFACE AND NEURAL STIMULATION **9+3**

Micro needles — Types, Fabrication, Drug delivery and biosensing- Neural signal Recording and Amplifications-Neuro chemical Recording. Electrode configuration and tissue volume conductor, Electrode- Electrolyte interface- Efficacy of Neural simulation - Stimulus generator architecture, Stimulation of front end circuits- Bioamplifier circuits and stimulation.

UNIT V: NEUROMEMITIC IC, AND LABEL FREE DIAGNOSTICS **9+3**

Neuron models for cell and network level- criteria and design strategies of nueromemitic IC - Fixed and Tunable model circuits. Label free molecular detection- Electrodes bio-functionalization, Bio chip application for DNA- Architectural optimizations for Digital Microfluidic biochips- Magnetotatic bacteria as the functional component in CMOS microelectronic Systems.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Study the Concept of Neural activity of the brain
- Design a CMOS circuits for Implantable devices.
- Study the use of Wireless technology in medical devices.
- Design and analyze the Micro needle fabrication.
- Design a Biochip for Biomedical Applications.

TEXT BOOKS

1. Krzysztof Iniewski, "VLSI Circuits for Biomedical Applications" Artech house Inc. 2008.
2. Rahul Sarpeshkar, "Ultra Low Power Bioelectronics: Fundamentals,Biomedical Applications and Bio-inspired Systems", Cambridge University Press, 2010.

REFERENCES

1. E. Sanchez-Sinencio and A. G. Andreau "Low-voltage/Low-power Integrated Circuits and Systems", Wiley,1998.
2. Khandpur RS, "Handbook of Biomedical Instrumentation", McGraw Hill, New Delhi,2014.

E- RESOURCES

1. https://nptel.ac.in/courses/102/107/102107058/(Biomedical)
2. https://nptel.ac.in/noc/courses/noc20/sem1/noc20-ee44/ (Bio medical application)

21PVP305 **RF IC DESIGN** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Study the various impedance matching techniques used in RF circuit design.
- Understand the functional design aspects of LNAs.
- Know the active and passive mixers.
- Analyze the tuning range of different oscillator circuits.
- Gain the knowledge of PLL and frequency synthesizers.

UNIT I: IMPEDANCE MATCHING IN AMPLIFIERS **9+3**

Definition of „Q", series parallel transformations of lossy circuits, impedance matching using „L",„PI" and T networks, Integrate Inductors, Resistors, Capacitors, tunable inductors, transformers.

UNIT II: AMPLIFIER DESIGN **9+3**

Noise characteristics of MOS devices, Design of CG LNA and inductor degenerated LNAs. Principles of RF Power Amplifiers design.

UNIT III: ACTIVE AND PASSIVE MIXERS **9+3**

Qualitative Description of the Gilbert Mixer - Conversion Gain, and distortion and noise , analysis of Gilbert Mixer - Switching Mixer - Distortion in Unbalanced Switching Mixer - Conversion Gain in Unbalanced Switching Mixer - Noise in Unbalanced Switching Mixer - A Practical Unbalanced Switching Mixer. Sampling Mixer - Conversion Gain in Single Ended Sampling Mixer - Distortion in Single Ended Sampling Mixer - Intrinsic Noise in Single Ended Sampling Mixer - Extrinsic Noise in Single Ended Sampling Mixer.

UNIT IV: OSCILLATORS **9+3**

LC Oscillators, Voltage Controlled Oscillators, Ring oscillators, Delay Cells, tuning range in ring oscillators, Tuning in LC oscillators, Tuning sensitivity, Phase Noise in oscillators, sources of phase noise.

UNIT V: PLL AND FREQUENCY SYNTHESIZERS **9+3**

Phase Detector/Charge Pump, Analog Phase Detectors, Digital Phase Detectors, Frequency Dividers, Loop Filter Design, Phase Locked Loops, Phase noise in PLL, Loop Bandwidth, Basic Integer-N frequency synthesizer, Basic Fractional-N frequency synthesizer.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand the principles of operation of an RF receiver front end and be able to design andapply constraints for LNAs, Mixers and Frequency synthesizers.
- Demonstrate in-depth knowledge in Radio Frequency Integrated Circuits.
- Analyze complex engineering problems critically for conducting research in RF systems.
- Solve engineering problems with wide range of solutions in Radio Frequency Integrated circuits.
- Apply appropriate techniques to engineering activities in the field of RF IC Design.

TEXT BOOKS

1. B.Razavi ,"RF Microelectronics" , Prentice-Hall ,2011.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" McGraw-Hill, 2017.

REFERENCES

1. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2004.
2. Thomas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits", Cambridge University Press, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/117/102/117102012/#(RF Integrated Circuits)
2. https://nptel.ac.in/courses/117/106/117106030/#(Analog IC Design)

PROFESSIONAL ELECTIVE V

21PVP306 HARDWARE VERIFICATION TECHNIQUES L T P C
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Know constrained random verification methods.
- Study Code coverage and functional coverage.
- Analyze Assertion based verification of high level modeling.
- Understand self checking test benches.
- Know the concept of Verification using UVM.

UNIT I: VERIFICATION TECHNOLOGIES 9+3

Importance of verification - reconvergence model-the human factor- formal and functional verification approaches –timing verification –testing versus verification-design and verification reuse-linting.

UNIT II: VERIFICATION TOOLS 9+3

Simulation-third party models-verification-intellectual property-waveform viewers-code coverage-functional coverage-issue tracking-metrics-roles of the verification plan –levels of verification — verification strategies.

UNIT III: HIGH LEVEL MODELING 9+3

High level versus RTL thinking-Structure of high level code-data abstraction-object oriented programming-parallel simulation engine-race issues-portability issues.

UNIT IV: TEST CASE GENERATION AND ARCHITECTING TESTBENCHES 9+3

Simple stimulus-simple output-complex stimulus-bus functional models -response monitors-transaction level Interface-verification harness- design configuration-self checking test benches-directed stimulus-random stimulus- system level verification harness – transaction level models – managing stimulation-regression.

UNIT V: VERIFICATION METHODOLOGY 9+3

Universal Verification Methodology (UVM) – packages -components – Environmental structures factory registration – reporting.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Analyze the verification strategies.
- Understand Structure of high level code.
- Discriminate high level versus RTL thinking.
- Design self checking test benches.
- Know the procedure for factory registration and reporting.

TEXT BOOKS

1. Chris Spear, Greg Tumbush, "System verilog for verification-A Guide to Learning thebest Language Features" Springer 3rd edition, 2012.
2. Kropf T, "Introduction to Formal Verification Technique" Springer verilog, 2010.

REFERENCES

1. Janick Bergeron, "Writing Test Benches Using System Verilog", Springer 1st Edition,2009.
2. Mark Glasser, "Open Verification Methodology Cookbook", Springer Verilog, 2010.

E- RESOURCES

1. https://nptel.ac.in/courses/117/103/117103125/ (VLSI Design verification and test)
2. https://nptel.ac.in/courses/106/103/106103116/ (Test of Digital VLSI circuits)

21PVP307 **VLSI FOR WIRELESS COMMUNICATION** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Understand the concepts of power amplifier.
- Study the Transmitter and receiver architectures of VLSI for wireless Communication.
- Understand the various types of mixers designed for wireless communication.
- Introduce the application of frequency synthesizers.
- Gain the basic Knowledge of receiver architecture.

UNIT I: OVERVIEW OF WIRELESS COMMUNICATION SYSTEMS **9+3**

Introduction of wireless system, Low Noise Amplifier – Matching Network, Wideband LNA –DC Bias-Gain and frequency Response-Noise Figure, Narrowband LNA - Impedance Matching-Matching of Imaginary and real Part-Interpretation of Power Matching, Core Amplifiers-Noise Figure-Power Dissipation, Trade- Off and Noise contribution from Other Sources.

UNIT II: TRANSMITTER ARCHITECTURE AND POWER AMPLIFIER **9+3**

Transmitter Back End, Quaderature LO generator-Single ended RC and LC, R-C with Differential stages Polyphase IQ generator-Divider based generator, Power Amplifier Design.

UNIT III: MIXERS **9+3**

Active Mixer: Balancing Mixer - Qualitative Description of the Gilbert Mixer - Conversion Gain – Distortion - Analysis of Gilbert Mixer of Low Frequency Case and High-Frequency Case - Noise. Passive Mixer: Switching Mixer — Distortion, Conversion Gain and Noise in Unbalanced Switching, Conversion Gain, Sampling Mixture, Gain, Distortion and noise in Single Ended Sampling Mixer.

UNIT IV: FREQUENCY SYNTHESIZER **9+3**

Phase Locked Loops - Phase Detector - VCO - Dividers - LC Oscillators - Ring Oscillators - Phase Noise — Loop Filter-First order filter-Second order filter, High Order filter, Digital Enhanced CordlessTelecommunication.

UNIT V: RECEIVER ARCHITECTURE **9+3**

Receiver Front end-Filter Design-Band selection Filter, Image Rejection Filter, Channel Filter, Restof receiver front end- non idealities and design parameters, Derivation of Noise Figure(NF) and input third order Intercept points(IIP3) of receiver front end, Partitioning of required NF and IIP3 ofreceiver front end into individual NF and IIP3.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Discuss the Low Noise Amplifier which includes wideband, narrow band for impedance matching and Core Amplifier.
- Illustrate the Transmitter Architectures and Power Amplifier.
- Describe the types of mixer and its parameters.
- Explain the application of frequency synthesizers.
- Illustrate the Receiver Architectures.

TEXT BOOKS

1. Bosco H Leung "VLSI for Wireless Communication", Pearson Education, 2nd edition,2002.
2. Carols and M. Stewart, "CMOS Wireless Transceiver Design," Boston, Kluwer Academic Publication, 1997.

REFERENCES

1. Thomas H.Lee, "The Design of CMOS Radio –Frequency Integrated Circuits',Cambridge University Press , 2003.
2. Emad N Farag and Mohamed I Elmasry, "Mixed Signal VLSI Wireless Design - Circuits and Systems", Kluwer Academic Publishers, 2000.

E - RESOURCES

1. https://nptel.ac.in/courses/117/102/117102012/ (Power Amplifiers)
2. https://nptel.ac.in/courses/117/102/117102062/ (Wireless Communication)

21PVP308	ASIC DESIGN	L T P C 3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Classify the types of ASIC and ASIC Library Design.
- Impart knowledge on Programmable ASICS.
- Programming ASIC design software and Low-Level Design Entry.
- Learn the architecture of different types routing.
- Know the high performance algorithms for ASICS.

UNIT I: INTRODUCTION TO ASICS, CMOS LOGIC AND ASIC LIBRARY DESIGN 9+3

Types of ASICs - Design flow - CMOS transistors - Combinational Logic Cell — Sequential logic cell - Data path logic cell - Transistors as Resistors - Transistor Parasitic Capacitance- Logical effort.

UNIT II: PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS AND PROGRAMMABLE ASIC I/O CELLS 9+3

Anti fuse - static RAM - EPROM and EEPROM technology - Actel ACT - Xilinx LCA – Altera FLEX - Altera MAX DC & AC inputs and outputs - Clock & Power inputs - XilinxI/O blocks**.**

UNIT III: PROGRAMMABLE ASIC ARCHITECTURE 9+3

Architecture and configuration of Spartan / Cyclone and Virtex / Stratix FPGAs – Micro-Blaze / Nios based embedded systems – Signal probing techniques.

UNIT IV: LOGIC SYNTHESIS, PLACEMENT AND ROUTING 9+3

Logic synthesis - ASIC floor planning- placement and routing – power and clocking strategies.

UNIT V: HIGH PERFORMANCE ALGORITHMS FOR ASICS/ SOCS.SOC CASE STUDIES 9+3

DAA and computation of FFT and DCT. High performance filters using delta-sigma modulators. Case Studies: Digital camera, SDRAM, High speed data standards.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to

- Analyze the passive elements for ASIC design Analyze the characteristics of Programmable ASIC I/O cells.
- Analyze the synthesis part on different logic structures.
- Construct the programmable ASIC architecture.
- Analyze the physical design flow of ASIC.
- Appreciate high performance algorithms available for ASICs.

TEXT BOOKS

1. M.J.S.Smith, " Application - Specific Integrated Circuits", Pearson,2003.
2. Wayne Wolf, FPGA-Based System Design, Prentice Hall PTR, 2004.

REFERENCES

1. R. Rajsuman, System-on-a-Chip Design and Test. Santa Clara, CA: Artech House Publishers, 2000.
2. F. Nekoogar. Timing Verification of Application-Specific Integrated Circuits (ASICs).Prentice Hall PTR, 2009.

E – RESOURCES

1. https://nptel.ac.in/courses/117/106/117106092/(Asic design)
2. https://nptel.ac.in/courses/108/106/108106177/(Digital Design)

21PVP309	NANO SCALE DEVICES	L T P C 3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
- Introduce the concepts of Multigate MOS systems.
- Study the various nanowire FETs.
- Understand the radiation effects in MOSFETS.
- Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristic.

UNIT I: INTRODUCTION TO NOVEL MOSFETS **9+3**

MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility– threshold voltage – inter subband scattering, multigate technology – mobility – gate stack.

UNIT II: PHYSICS OF MULTIGATE MOS SYSTEMS **9+3**

MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics –CMOS Technology — Ultimate limits, double gate MOS system — gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering – mobility.

UNIT III: NANOWIRE FETS AND TRANSISTORS AT THE MOLECULAR SCALE **9+3**

Silicon nano wire MOSFETs — Evaluvation of I-V characteristics — The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube — Band structure of carbon nanotube — Band structure of graphene — Physical structure of nanotube — Band structure of nanotube — Carbon nanotube FETs — Carbon nanotube MOSFETs — Schottky barrier carbon nanotube FETs — Electronic conduction in molecules – General model for ballistic nano transistors – MOSFETs with 0D, 1D, and 2D channels– Molecular transistors – Single electron charging – Single electron transistors.

UNIT IV: RADIATION EFFECTS **9+3**

Radiation effects in SOI MOSFETs, total ionizing dose effects — single gate SOI — multigate devices, single event effect, scaling effects**.**

UNIT V: CIRCUIT DESIGN USING MULTIGATE DEVICES **9+3**

Digital circuits – impact of device performance on digital circuits – leakage performance trade off – multi VT devices and circuits – SRAM design, analog circuit design – transconductance -intrinsic gain – flicker noise – self heating –band gap voltage reference – operational amplifier – comparator designs, mixed signal – successive approximation DAC, RF circuits.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to:

- Design circuits using nano scaled MOS transistors with the physical insight of their functional characteristics.
- Understand and study the physics behind the operation of multi-gate systems
- Study the MOS devices used below 10nm and beyond with an eye on the future.
- Analyze the radiation effects in MOSFETS.
- Summarize the present and future research frontiers of Nano electronics and to be able to critically assess future trends.

TEXT BOOKS

1. J.P.Colinge, "FINFETs and other multi-gate transistors", Springer – Series on integrated circuits and systems, 2008.
2. Mark Lundstrom, Jing Guo, "Nanoscale Transistors: Device Physics, Modeling and Simulation", Springer, 2006.

REFERENCES

1. M.S.Lundstorm, "Fundamentals of Carrier Transport", 2nd Ed., Cambridge University Press,Cambridge UK, 2000.
2. Handbook of Nanofabrication: Editor Gary P. Wiederrecht, Elsevier Publication, Academic Press, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/117/108/117108047/ (Nano Electronics Device and Materials)
2. https://nptel.ac.in/courses/108/101/108101089/ (VLSI circuits using MOS Technology)

21PVP310 **IP BASED VLSI DESIGN** **L T P C**
3 1 0 4

OBJECTIVES

The main objective of this course is to:

- Learn about IC manufacturing and fabrication.
- Analyze the combinational networks design.
- Understand sequential and subsystem design.
- Study about different floor planning techniques and architecture design.
- Have an introduction to IP design security.

UNIT I: VLSI AND ITS FABRICATION **9+3**

Introduction, IC manufacturing, CMOS technology, IC design techniques, IP based design, Fabrication process-Transistors, Wires and Via, Fabrication Theory reliability, Layout Design and tools.

UNIT II: COMBINATIONAL LOGIC NETWORKS **9+3**

Logic Gates: Combinational Logic Functions, Static Complementary Gates, Switch Logic, Alternate Gate circuits, Low power gates, Delay, Yield, Gates as IP, Combinational Logic Networks- Standard Cell based Layout, Combinational network delay, Logic and Interconnect design, Power optimization, Switch logic network, logic testing.

UNIT III: SUBSYSTEM DESIGN **9+3**

Sequential Machine-Latch and Flip flop, System design and Clocking, Performance analysis, power optimization, Design validation and testing; Subsystem Design-Combinational Shifter, Arithmetic Circuits, High Density memory, Image Sensors, FPGA,PLA, Buses and NoC, Datapaths, Subsystems as IP.

UNIT IV: FLOOR PLANNING AND ARCHITECTURE DESIGN **9+3**

Floor planning-Floor planning methods, Global Interconnect, Floor plan design, Off-chip Connections Architecture Design- HDL, Register-Transfer Design, Pipelining, High Level Synthesis, Architecture for Low power, GALS systems, Architecture Testing, IP Components, Design Methodologies, Multiprocessor System-on-chip Design.

UNIT V: DESIGN SECURITY **9+3**

IP in reuse based design, Constrained based IP protection, Protection of data and Privacy constrained based watermarking for VLSI IP based protection.

TOTAL: 45+15=60 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Understand IP based design techniques.
- Knowledge of combinational logic gates.
- Study the subsystem design.
- Understand floor planning methods.
- Design security systems.

TEXT BOOKS

1. Wayne wolf, "Modern VLSI Design: IP-based Design", Pearson Education,2009.
2. Qu gang, Miodrag potkonjak, "Intellectual Property Protection in VLSI Designs: Theory and Practice", kluwer academic publishers, 2003.

REFERENCES

1. Sorab K. Ghand," VLSI Fabrication Principles: Silicon and Gallium Arsenide", 2nd Edition,1994.
2. Khaled Salah Mohamed " IP Cores Design from Specifications to Production: Modeling, Verification, Optimization, and Protection (Analog Circuits and Signal Processing)" 1st ed. 2016 Edition, Kindle Edition.

E-RESOURCES

1. https://nptel.ac.in/courses/108/107/108107129/ (Combinational Logic Design)
2. https://nptel.ac.in/courses/113/106/113106062/ (IC Device fabrication)

PROFESSIONAL ELECTIVE VI

21PVP311	VLSI FOR IOT SYSTEMS	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce the concepts of IoT Systems.
- Know the Components of IoT.
- Construct fabrication of IC technology.
- Understand the Electronic system design for IoT.
- Analysis of IoT systems.

UNIT I : INTRODUCTION **9**

Concept of connected world, Need, Legacy systems for connected world, features and limitations, key features of IoT architecture, Merits and Demerits of IoT Technology, Applications driven by IoT technology, examples.

UNIT II: COMPONENTS OF IOT **9**

Review of classic embedded system architecture ,Basic building blocks of an IoT system, Artificial Intelligence, Connectivity, Sensors and computing nodes. Sensors used in IoT Systems, Characteristics and requirements, Types of sensors for IoT systems, Compute nodes of IoT,Connectivity technologies in IoT, Software in IoT systems, features and properities.

UNIT III: IC TECHNOLOGY FOR IOT **9**

SoC Architecture for IoT devices, Application processor, microcontrollers, smart analog, memory architecture for IoT, Non volatile memories(NVM),Embedded non volatile memories, Anti-fuse one time programmable(OTP) memories, Power management, Low drop out regulators, DC-to DC Converters, Voltage References, Power Management Units(PMUs) in IC's and Systems, Role of Field Programmability in IoT systems.

UNIT IV: ELECTRONIC SYSTEM DESIGN FOR IOT **9**

Electronic system Design for IoT, Requirements, Computing blocks in IoT systems, MCU's, DSPs and FPGA's, System power supply design for IoT systems, Mixed signal challenges in hardware systems, Form Factor, Guidelines and prevailing standards.

UNIT V: ANALYSIS OF IOT SYSTEMS **9**

Component models and System Design, Feasibility and challenges, System level integration, Operating conditions of IoT devices and impact on Electronic System design, hardware security issues, EMI/EMC, SI/PI and Reliability analysis in IoT systems.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to:

- Study the concepts of VLSI IoT systems.
- Understand Components of IoT.
- Known the IC technology for IoT.
- Analysis of Electronic system design.
- Impart knowledge of Component models and system design.

TEXT BOOKS

1. Alloto,"Enabling the internet of Things from Integrated Circuits to Integrated systems",SpringerPublications,1st Edition,2017.
2. Pieter Harpe,Kofi A,A makinwaAndrea Baschirotto, " Hybrid ADCs,Smart sensors for the IoT,and sub-1V& Advanced Node analog circuit Design",Springer International Publishing AG,2017.

REFERENCES

1. Rashid khan,Ajith vasudevan,"Learning IoT with Particle Photon and Electron",Packt PublishingLimited(Verlag),2016.
2. ApekMulay, "Sustaining Moore's Law: Uncertainty Leading to a certainty of IoT Revolution",Margan and Claypool Publishers,2015.

E-RESOURCES

1. https://nptel.ac.in/courses/108/108/108108111/ (Introduction of IC)
2. https://www.digimat.in/nptel/courses/video/108101089/l21.html (Fabrication of MOS)

21PVP312 VLSI ARCHITECTURE FOR IMAGE AND VIDEO PROCESSING **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Analyze the Image and Video processing algorithms.
- Explore various processing techniques of Image and Video signals.
- Design different architectures of Image and Video signals.
- Analysis of Fast Motion Estimation Algorithms.
- Analysis various VLSI architectures for video processing

UNIT I: IMAGE PROCESSING ALGORITHMS **9**

Introduction — Image Processing Tasks- Low level Image Processing Operations — Description of some intermediate level operations – Requirements for Image processor architecture.

UNIT II: IMAGE PROCESSING ARCHITECTURES AND PIPELINED LOW LEVEL IMAGE PROCESSING **9**

Classification of Architectures — Uni and Multi processors — MIMD systems — SIMD systems – Pipelines – Devices for cellular logic processing – Design aspects of real timelow level image processors – Design method for special architectures.

UNIT III: TPIPELINED ARCHITECTURES & 2D AND 3D IMAGE PROCESSING ARCHITECTURES **9**

Architecture of a cellular logic processing element — Second decomposition in data path and control –Real time pipeline for low level image processing — Design aspects of Image Processing architectures Implementation of Low level 2D and 3D and Intermediate level algorithms.

UNIT IV: VIDEO PROCESSING ALGORITHMS **9**

Motion Estimation Algorithms – Complexity Analysis Methodology – Complexity analysis of MPEG 4 Visual – Analysis of Fast Motion Estimation Algorithms.

UNIT V: VLSI ARCHITECTURES FOR VIDEO PROCESSING **9**

General design space evaluation – Design space motion estimation architectures – Motion estimation architectures for MPEG-4 – Design Trade-offs – VLSI Implementation search engine Iand Search engine II.

TOTAL: 45 PERIODS

OUTCOMES

At the end of this course, the students should be able to:

- Apply various architectures to realize Image processing algorithms.
- Analyze the pipeline architectures for image processing.
- Implementation of Low level 2D and 3D and Intermediate level algorithms.
- Evaluate the performances of video processing algorithms.
- Implement various architectures for video Processing.

TEXT BOOKS

1. Peter M. Kuhn, "Algorithms, Complexity Analysis and VLSI Architectures for MPEG-4 Motion Estimation ", Springer ISBN 978-1–4419-5088-8, 1st Edition, 2012.
2. Pieter Jonker, "Morphological Image Processing: Architecture and VLSI design",Springer. ISBN:9020127667, 1st Edition, 2000.

REFERENCES

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", Prentice Hall; 3rd edition, 2007.
2. A.Murat Tekalp, "Digital Video Processing", Pearson Education, Noida, 1st Edition,2010.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105135/(Image Processing).
2. https://nptel.ac.in/courses/117/105/117105079/ (Digital Image Processing).

21PVP313 **HARDWARE - SOFTWARE CO-DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Acquire knowledge about system specification and modeling.
- Familiarize the design of hardware/software partitioning.
- Understand the concepts of hardware/software co-synthesis.
- Study the different technical aspects about prototyping and emulation.
- Impart knowledge of design specification and verification.

UNIT I: SYSTEM SPECIFICATION AND MODELLING **9**

Embedded Systems, Hardware/Software Co-Design, Co-Design for System Specification and Modeling , Co-Design for Heterogeneous Implementation - Single-Processor Architectures with one ASIC and many ASICs, Multi-Processor Architectures, Comparison of Co- Design Approaches, Models of Computation, Requirements for Embedded System Specification.

UNIT II: HARDWARE / SOFTWARE PARTITIONING **9**

The Hardware/Software Partitioning Problem, Hardware-Software Cost Estimation, Generation of the Partitioning Graph, Formulation of the HW/SW Partitioning Problem, Optimization, HW/SW Partitioning based on Heuristic Scheduling, HW/SW Partitioning based on Genetic Algorithms.

UNIT III: HARDWARE / SOFTWARE CO-SYNTHESIS **9**

The Co-Synthesis Problem, State-Transition Graph, Refinement and Controller Generation, Co-Synthesis Algorithm for Distributed System- Case Studies with any one application.

UNIT IV: PROTOTYPING AND EMULATION **9**

Introduction, Prototyping and Emulation Techniques , Prototyping and Emulation Environments, Future Developments in Emulation and Prototyping ,Target Architecture- Architecture Specialization Techniques, System Communication Infrastructure, Target Architectures and Application System Classes, Architectures for Control-Dominated Systems, Architectures for Data- Dominated Systems ,Mixed Systems and Less Specialized Systems.

UNIT V: DESIGN SPECIFICATION AND VERIFICATION **9**

Concurrency, Coordinating Concurrent Computations, Interfacing Components, Verification ,Languages for System-Level Specification and Design System-Level Specification, Design Representation for System Level Synthesis, System Level Specification Languages, Heterogeneous Specification and Multi- Language Co- simulation.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to

- Understand the concepts of system specification and modeling.
- Analyze the hardware/software partitioning.
- Compare hardware / software co-synthesis.
- Assess prototyping and emulation technique.
- Formulate the design specification and validate its functionality by simulation.

TEXT BOOKS

1. Giovanni De Micheli , Rolf Ernst Morgon," Reading in Hardware/Software Co-Design"Kaufmann Publishers, 2013.
2. Jorgen Staunstrup, Wayne Wolf ,"Hardware/Software Co-Design: Principles and Practice" ,Kluwer Academic Pub,2010.

REFERENCES

1. Ralf Niemann , "Hardware/Software Co-Design for Data Flow Dominated Embedded Systems", Kluwer Academic Pub, 1998.
2. F.Balarin, Chiodo"Hardware/Software Co-Design of Embedded Systems", Kluwer Academic Pub, 1997.

E- RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_cs14 (Embeeded design)
2. https://nptel.ac.in/courses/108/108/108108157/ (electronics prototype buliding)

21PVP314 **SELECTED TOPICS IN IC DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the concepts of voltage and current references.
- Design and analyze low drop out regulators.
- Able to understand oscillator fundamentals.
- Study the concepts of phase lock loops.
- Impart knowledge on clock and data recovery.

UNIT I: VOLTAGE AND CURRENT REFERENCES **9**

Current Mirrors, Self Biased Current Reference, startup circuits, VBE based Current Reference, VT Based Current Reference, Band Gap Reference , Supply Independent Biasing, Temperature Independent Biasing, PTAT Current Generation, Constant Gm Biasing.

UNIT II: LOW DROP OUT REGULATORS **9**

Analog Building Blocks, Negative Feedback, AC Design, Noise and Noise Reduction Techniques, Stability, LDO Efficiency, LDO Current Source, LDO Current Source Using Opamp.

UNIT III: OSCILLATOR FUNDAMENTALS **9**

General considerations, Ring oscillators, LC oscillators, Colpitts Oscillator, Jitter and Phase noise in Ring Oscillators, Impulse Sensitivity Function for Ring Oscillators, Phase Noise in Differential LC Oscillators.

UNIT IV: PHASE LOCK LOOPS **9**

PLL Fundamental, PLL stability, Noise Performance, Charge-Pump PLL Topology, CPPLL Building blocks, Jitter and Phase Noise performance.

UNIT V: CLOCK AND DATA RECOVERY **9**

CDR Architectures, TIAs and Limiters, CMOS Interface, Linear Half Rate CMOS CDR Circuits, Wide capture Range CDR Circuits.

TOTAL: 45 PERIODS

OUTCOMES

Upon Completion of the course, the students will be able to

- Study the basics of voltage and current references.
- Design the low drop out regulators.
- Acquire basic knowledge of oscillator fundamentals.
- Develop the skill to phase lock loops.
- Understand the concept of CDR.

TEXT BOOKS

1. Behzad Razavi, "Design of Integrated circuits for Optical Communications", McGraw Hill,2003.
2. Floyd M. Gardner ,"Phase Lock Techniques" John Wiley & Sons, Inc 2005.

REFERENCES

1. Gabriel.A. Rincon-Mora, "Voltage references from diode to precision higher orderbandgapcircuits", John Wiley& Sons, Inc 2002.
2. High Speed Clock and Data Recovery, High-performance Amplifiers Power ManagementSpringer, 2008.

E - RESOURCES

1. https://nptel.ac.in/courses/108/106/108106158/ (Digital IC Design)
2. https://onlinecourses.nptel.ac.in/noc21_ee22/preview (IC Design)

21PVP315 **MEMS AND NEMS** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Introduce the concepts of micro electromechanical devices.
- Know the fabrication process of Microsystems.
- Have a concept on the scope and recent development of the science and technology ofmicro- and nano-systems.
- Gain the physical knowledge underlying the operation principles and design of micro and nano- systems.
- Learn some typical or potentially applicable micro- and nano-systems at the frontier of the development of the field.

UNIT I: OVERVIEW **9**

New trends in Engineering and Science: Micro and Nano scale systems, Introduction to Design of MEMS and NEMS, MEMS and NEMS — Applications, Devices and structures. Materials for MEMS: Silicon, silicon compounds, polymers, metals.

UNIT II: MEMS FABRICATION TECHNOLOGIES **9**

Micro system fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT III: MICRO SENSORS **9**

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor.

UNIT IV: MICRO ACTUATORS **9**

Design of Actuators:Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate,Torsion bar,Comb drive actuators), Micromechanical Motors and pumps.Case study:Comb drive actuators.

UNIT V: NANOSYSTEMS AND QUANTUM MECHANICS **9**

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

OUTCOMES

At the end of the course, the students will be able to:

- Discuss micro and Nano scale systems.
- Understand MEMS fabrication technologies.
- Outline the Micro sensors.
- Know the operation of micro actuators and their applications.
- Ability to design the atomic structures and quantum mechanics.

TEXT BOOKS

1. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.
2. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.

REFERENCES

1. Stephen D. Senturia," Micro system Design", Kluwer Academic Publishers,2001.
2. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures" CRCPress, 2002.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105082/(MEMS and Microsystems)

2.https://nptel.ac.in/courses/108/108/108108113/|(MEMS)

M.B.A. DEGREE PROGRAMME

SEMESTER I

21BAT101	**ECONOMIC ANALYSIS FOR BUSINESS**	**L T P C** **4 0 0 4**

OBJECTIVES

The objective of this course will enable students to:

- Introduce the concepts of scarcity and efficiency
- Explain behavior of Producer and consumer
- Understanding Product and factor market
- Understanding of performance of an economy .
- Learn the impact of inflation and unemployment

UNIT I: INTRODUCTION **8**

The themes of economics - scarcity and efficiency - three fundamental economic problems - society's capability - Production possibility frontiers (PPF) - Productive efficiency Vs economic efficiency - economic growth & stability - Micro economies and Macro economies - the role of markets and government - Positive Vs negative externalities.

UNIT II: CONSUMER AND PRODUCER BEHAVIOUR **13**

Market - Demand and Supply - Determinants - Market equilibrium - elasticity of demand and supply - consumer behaviour - consumer equilibrium - Approaches to consumer behaviour - Production - Short-run and long-run Production Function - Returns to scale - economies Vs diseconomies of scale - Analysis of cost - Short-run and long-run cost function - Relation between Production and cost function.

UNIT III: PRODUCT AND FACTOR MARKET **13**

Product market - perfect and imperfect market - different market structures - Firm‟s equilibrium and supply - Market efficiency - Economic costs of imperfect competition - factor market - Land, Labour and capital - Demand and supply - determination of factor price - Interaction of product and factor market - General equilibrium and efficiency of competitive markets.

UNIT IV: PERFORMANCE OF AN ECONOMY - MACRO ECONOMICS **13**

Macro-economic aggregates - circular flow of macroeconomic activity - National income determination - Aggregate demand and supply - Macroeconomic equilibrium - Components of aggregate demand and national income - multiplier effect - Demand side management - Fiscal policy in theory.

UNIT V: AGGREGATE SUPPLY AND THE ROLE OF MONEY **13**

Short-run and Long-run supply curve - Unemployment and its impact - Okun"s law - Inflation andthe impact - reasons for inflation - Demand Vs Supply factors -Inflation Vs Unemployment tradeoff - Phillips curve -short- run and long-run -Supply side Policy and management- Money market- Demand and supply of money - money-market equilibrium and national income - the role of monetary policy.

TOTAL: 60 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Students are expected to become familiar with both principles of micro and macro economics.
- Students become familiar with market equilibrium and elasticity of demand and supply.
- Discuss about different market structure and price determination
- Enabling the importance of Macro economic activities
- Understanding inflation and unemployment and its impact.

TEXT BOOKS

1. Paul A. Samuelson, William D. Nordhaus, Sudip Chaudhuri and Anindya Sen, Economics,19th Edition, Tata McGraw Hill, New Delhi, 2010.
2. Gregory Mankiw, N. Principles of Economics, 7th edition, Cengage, New Delhi, 2014

REFERENCES

1. Richard Lipsey and Alec Charystal, Economics, 12th edition, Oxford, University Press**,** New Delhi, 2011.
2. William Boyes and Michael Melvin, Textbook of economics, Biztantra,9th Edition , 2012.

E-RESOURCES

1. https://www.intelligenteconomist.com/types-of-economies/ (Economic Systems)
2. https://www.econlib.org/library/Topics/College/whatiseconomics.html/(Introduction Economics)

21BAT102 **PRINCIPLES OF MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Familiarize the students to the basic concepts of management in order to aid in understanding how an organization functions,
- Understanding the complexity and wide variety of issues of policies and strategies for planning
- Discuss about different structure of organization.
- Familiarize with organization culture and communication.
- Understanding the control activities of an organization

UNIT I: INTRODUCTION TO MANAGEMENT **9**

Organization- Management- Role of managers- Evolution of management thought- Organization and the environmental factors- Managing globally- Strategies for International business.

UNIT II: PLANNING **9**

Nature and purpose of planning- Planning process- Types of plans- Objectives- Managing by Objective (MBO) strategies- Types of strategies - Policies - Decision Making- Types of decision- Decision making process- Rational decision making process- Decision making under different conditions.

UNIT III: ORGANISING **9**

Nature and purpose of organizing- Organization structure- Line and staff authority- Departmentation- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Career development- Career stages- Training- Performance appraisal.

UNIT IV: DIRECTING **9**

Managing people- Communication- Hurdles to effective communication - Organization culture - Elements and types of culture- Managing cultural diversity.

UNIT V: CONTROLLING **9**

Process of controlling- Types of control- Budgetary and non-budgetary control techniques- Managing productivity- Cost control- Purchase control- Maintenance control- Quality control- Planning operations.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Describe and discuss the elements of effective management.
- Discuss and apply the planning, decision making processes.
- Describe various activities related to organizing and recruitment processes.
- Communicate effectively through both oral and written presentation.
- Familiarize with control mechanism of an organization.

TEXT BOOKS

1. Harold Koontz and Heinz Weihrich, Essentials of management: An International & Leadership Perspective, 9th edition, Tata McGraw-Hill Education, 2012.
2. Andrew J. Dubrin, Essentials of Management, Thomson Southwestern, 9th edition, 2012.

REFERENCES

1. Heinz Weihrich, Mark V Cannice and Harold Koontz, Management- A global entrepreneurial perspective, Tata McGraw Hill, 13th edition, 2010.
2. Don Hellriegel, Susan E. Jackson and John W. Slocum, Management- A competency-based approach, Thompson South Western, 11th edition, 2008.

E-RESOURCES

1. https://www.slideshare.net/imee5/theories-of-educational-management(Theories of educational management)
2. https://www.managementstudyhq.com/functions-of-management.html(Functions of management)

21BAT103 **ACCOUNTING FOR MANAGEMENT** **L T P C**
4 0 0 4

OBJECTIVES

The objective of this course will enable students to:

- Acquire a reasonable knowledge in accounts.
- Learn the different kind of company accounts
- Analyze and evaluate financial statements.
- Understand the concept of Cost accounting
- Familiarized with computerized accounting environment

UNIT I: FINANCIAL ACCOUNTING **12**

Introduction to Financial, Cost and Management Accounting- Generally accepted accounting principles, Conventions and Concepts-Balance sheet and related concepts- Profit and Loss account and related concepts - Introduction to inflation accounting- Introduction to human resources accounting.

UNIT II: COMPANY ACCOUNTS **12**

Meaning of Company - Maintenance of Books of Account- Statutory Books- Profit or Loss Prior to incorporation- Final Accounts of Company- Alteration of share capital- Preferential allotment, Employees stock option- Buyback of securities.

UNIT III: ANALYSIS OF FINANCIAL STATEMENTS **12**

Analysis of financial statements - Financial ratio analysis, cash flow (as per Accounting Standard 3) and funds flow statement analysis.

UNIT IV: COST ACCOUNTING **12**

Cost Accounts - Classification of manufacturing costs - Accounting for manufacturing costs. Cost Accounting Systems: Job order costing - Process costing- Activity Based Costing- Costing and the value chain- Target costing- Marginal costing including decision making- Budgetary Control & Variance Analysis - Standard cost system.

UNIT V: ACCOUNTING IN COMPUTERISED ENVIRONMENT **12**

Significance of Computerised Accounting System- Codification and Grouping of Accounts- Maintaining the hierarchy of ledgers- Prepackaged Accounting software.

TOTAL: 60 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Possess a managerial outlook at accounts**.**
- Understanding kinds of accounts and its maintenance.
- Illustrating financial statements.
- Discuss about different kinds of cost.
- Familiarized with computerized accounting environment.

TEXT BOOKS

1. R.Narayanaswamy, Financial Accounting - A managerial perspective, PHI Learning, New Delhi, 2011.
2. Jan Williams, Financial and Managerial Accounting - The basis for business Decisions,15th edition, Tata McGraw Hill Publishers, 2010.

REFERENCES

1. M.Y.Khan & P.K.Jain, Management Accounting, Tata McGraw Hill, 2011.
2. Horngren, Surdem, Stratton, Burgstahler, Schatzberg, Introduction to Management Accounting, PHI Learning, 2011.

E-RESOURCES

1. https://www.myaccountingcourse.com › Accounting Dictionary(Accounting Dictionary)
2. https://www.accountingtools.com/accounting-for-managers(Accounting Tools)

21BAT104 **LEGAL ASPECTS OF BUSINESS** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- To create the knowledge of Legal perspective and its practices to improvise the business.
- Familiarize with types of companies and corporate governance .
- Discuss about laws related to industry.
- Understand GST and its practical implications.
- Familiarize with act related to consumer protection and cyber crimes.

UNIT I: COMMERCIAL LAW THE INDIAN CONTRACT ACT 1872 **9**

Definition of contract, essentials elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract of Agency: Nature of agency, Creation and types of agents, Authority and liability of Agent and principal: Rights and duties of principal and agents, termination of agency.

THE SALE OF GOODS ACT 1930

Nature of Sales contract, Documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller - Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments. Types of negotiable instruments, liability of parties, holder in due course, special rules for Cheque and drafts, discharge of negotiable instruments-GST

UNIT II: COMPANY LAW 2013 **9**

Major principles - Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Corporate Governance.

UNIT III: INDUSTRIAL LAW **9**

An Overview of Factories Act - Payment of Wages Act - Payment of Bonus Act - Industrial Disputes Act.

UNIT IV: CORPORATE TAX AND GST **9**

Corporate Tax Planning, Income Tax, Goods and Services Tax – Introduction, Objective, Classification and Practical implications of GST.

UNIT V: CONSUMER PROTECTION ACT AND INTRODUCTION OF CYBER LAWS 9

Consumer Protection Act - Consumer rights, Procedures for Consumer grievances redressal, Types of consumer Redressal Machineries and Forums- Competition Act 2002 - Cyber crimes, IT Act 2000 and 2002, Cyber Laws, Introduction of IPR - Copy rights, Trade marks, Patent Act.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Legal insight will be established in the business practices according to the situationof changing environment.
- Understanding the major principles of company law .
- Enabling the importance of Industrial law.
- Illustrating GST and its implications.
- Know the concept of Consumer protection and cyber law.

TEXT BOOKS

1. Akhileshwar Pathack, Legal Aspects of Business, 4th Edition, Tata McGraw Hill, 2009.
2. Kapoor, N. D.; Elements of Mercanlite Law, 30th edition, Sultan Chand & Sons, NewDelhi,2015

REFERENCES

1. P. P. S. Gogna, Mercantile Law, S. Chand & Co. Ltd., India, 11th Edition, 2015
2. Maheshwari, S.N. and S.K. Maheshwari; A Manual of Business Law, 6th Edition, Himalaya Publishing House, 2015.

E-RESOURCES

1. www.gurukpo.com/legal-aspects-of-indian-business/(Legal Aspects of Indian Business)
2. https://www.mbanotescorner.com/2012/10/legal-aspects-notes.html(Legal Aspects Notes)

21BAT105 ORGANIZATIONAL BEHAVIOUR L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide an overview of theories and practices in organizational behavior in individual,group and organizational level.
- Provide an overview of theories and practices in organizational behavior in individual Behaviour.
- Understand the behaviour of people as group.
- Discuss about qualities of leadership and their power in organization
- Understand organizational climate and culture and factors affecting it.

UNIT I: FOCUS AND PURPOSE 5

Definition, need and importance of organizational behaviour - Nature and scope - Frame work - Organizational behaviour models.

UNIT II: INDIVIDUAL BEHAVIOUR 12

Personality - types - Factors influencing personality - Theories - Learning - Types of learners - The learning process - Learning theories - Organizational behaviour modification. Misbehaviour - Types - Management Intervention. Emotions - Emotional Labour - Emotional Intelligence - Theories. Attitudes - Characteristics - Components - Formation - Measurement- Values. Perceptions - Importance - Factors influencing perception - Interpersonal perception- ImpressionManagement. Motivation - Importance - Types - Effects on work behavior.

UNIT III: GROUP BEHAVIOUR 10

Organization structure - Formation - Groups in organizations - Influence - Group dynamics - Emergence of informal leaders and working norms - Group decision making techniques - Team building - Interpersonal relations - Communication - Control.

UNIT IV: LEADERSHIP AND POWER 8

Meaning - Importance - Leadership styles - Theories - Leaders Vs Managers - Sources of power - Power centers - Power and Politics.

UNIT V: DYNAMICS OF ORGANIZATIONAL BEHAVIOUR 10

Organizational culture and climate - Factors affecting organizational climate - Importance. Job satisfaction - Determinants - Measurements - Influence on behavior. Organizational change - Importance - Stability Vs Change - Proactive Vs Reactive change - the change process –

Resistance to change - Managing change. Stress - Work Stressors - Prevention and Management of stress - Balancing work and Life. Organizational development — Characteristics -objectives -. Organizational effectiveness, Developing Gender sensitive workplace.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Better understanding of human behavior in organization.
- Knowthe framework for managing individual performance.
- Evaluate the importance and influence of groups in an organization.
- Know the importance and types of leadership and impact of power and politics.
- Understanding the factors affecting organizational climate and importance of change in organization.

TEXT BOOKS

1. Stephen P. Robins, Organisational Behavior, PHI Learning Pearson Education, 17th Edition 17, 2016 (Global edition).
2. Fred Luthans, Organisational Behavior, McGraw Hill, 12th Edition.

REFERENCES

1. Mc Shane & Von Glinov, Organisational Behaviour, 4th Edition, Tata Mc Graw Hill, 2007.
2. Ivancevich, Konopaske & Maheson, Oranisational Behaviour & Management, 7th edition,Tata McGraw Hill, 2008.

E-RESOURCES

1. https://ebrary.net/2819/management/group_behaviour (Group behavior,Group Norms)
2. www.nptel.ac.in/courses/122106031/Pdfs/7_1.pdf(Management Concepts)

21BAT106 **STATISTICS FOR MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the applications of statistics in business decision making.
- Acquire knowledge of sampling distribution and estimation.
- Provide information about parametric tests.
- Test the hypothesis about the population using of and Chi-square test.
- Provide information about Estimation theory and Regression lines.

UNIT I: INTRODUCTION **9**

Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II: SAMPLING DISTRIBUTION AND ESTIMATION **9**

Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. Estimation: Point and Interval estimates for population parameters of large samples and small samples, determining the sample size.

UNIT III: TESTING OF HYPOTHESIS - PARAMETIRC TESTS **9**

Hypothesis testing: one sample and two sample tests for means and proportions of large samples (z-test), one sample and two sample tests for means of small samples (t-test), F-test for two sample standard deviations. ANOVA: one and two way.

UNIT IV: NON-PARAMETRIC TESTS **9**

Chi-square test for single sample standard deviation. Chi-square tests for independence of attributes and goodness of fit. Sign test for paired data. Rank sum test. Kolmogorov-Smirnov - test for goodness of fit, comparing two populations. Mann - Whitney U test and Kruskal Wallis test. One sample run test.

UNIT V: CORRELATION AND REGRESSION **9**

Correlation - Coefficient of Determination - Rank Correlation - Regression - Estimation of Regression line - Method of Least Squares - Standard Error of estimate.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understanding the basic definition and rules for Probability.
- Use the concept of Estimation theory.
- Interpret the difference between different parametric test.
- Frame the hypothesis for non parametric test.
- Apply different kind of correlation and identify standard error of estimate.

TEXT BOOKS

1. Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqui, Statistics forManagement, Pearson Education, 7th Edition, 2016.
2. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2016.

REFERENCES

1. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2012.
2. Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics,11th edition, Thomson (South - Western) Asia, Singapore, 2012.

E-RESOURCES

1. https://www.datasciencecentral.com/.../difference-between-correlation-and-regression-.. (Difference between Correlation and Regression)
2. https://www.statpac.com/statistics-calculator/correlation-regression.html(Correlation coefficient calculator)

21BAT107 **TOTAL QUALITY MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the quality philosophies and tools in the managerial perspective.
- Familiarize with Principles and philosophies of Quality management.
- Understand meaning and significance of Statistical process control.
- Discuss tools and techniques for quality management.
- Understand different kind of quality systems for organizations.

UNIT I: INTRODUCTION **9**

Quality - vision, mission and policy statements. Customer Focus - customer perception of quality, Translating needs into requirements, customer retention. Dimensions of product and service quality. Cost of quality.

UNIT II: PRINCIPLES AND PHILOSOPHIES OF QUALITY MANAGEMENT **9**

Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques - introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.

UNIT III: STATISTICAL PROCESS CONTROL **9**

Meaning and significance of statistical process control (SPC) - construction of control charts for variables and attributes. Process capability - meaning, significance and measurement - Six sigma - concepts of process capability. Reliability concepts - definitions, reliability in series and parallel, product life characteristics curve. Total productive maintenance (TPM), Terotechnology. Business process Improvement (BPI) - principles, applications, reengineeringprocess, benefits and limitations.

UNIT IV: TOOLS AND TECHNIQUES FOR QUALITY MANAGEMENT **9**

Quality Functions Deployment (QFD) - Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) - requirements of reliability, failure rate, FMEA stages, design, process and documentation. Seven Tools (old & new). Bench marking and POKA YOKE.

UNIT V: QUALITY SYSTEMS ORGANIZING AND IMPLEMENTATION **9**

Introduction to IS/ISO 9004:2000 - quality management systems - guidelines for performance improvements. Quality Audits. TQM culture, Leadership - quality council, employee involvement, motivation, empowerment, recognition and reward - TQM framework, benefits, awareness and obstacles.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Apply quality philosophies and tools to facilitate continuous improvement and ensure customer delight.
- Understanding different principles and philosophies of quality.
- Construct and Apply statistical process control chart for variables and attributes.
- Discuss about tools and techniques for Quality management.
- Understanding different kind of quality systems for organizations.

TEXT BOOKS

1. Dale H.Besterfield, Carol Besterfield - Michna, Glen H. Besterfield, Mary Besterfield - Sacre, Hermant - Urdhwareshe, Rashmi Urdhwareshe, Total Quality Management, Revised Third edition, Pearson Education, 2011
2. Douglas C. Montgomory, Introduction to Statistical Quality Control, Wiley Student Edition, 4th Edition, Wiley India Pvt Limited, 2008.

REFERENCES

1. James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2005.
2. Poornima M.Charantimath, Total Quality Management, Pearson Education, Second Edition , 2011

E-RESOURCES

1. https://www.business-online-learning.com›DimensionsofQuality/ - (Dimensions of Quality)
2. https://www.simplexpayroll.com/blog/.../the-philosophies-of-total-quality-management/(Total Quality Management principles to improve the processes)

21BAE101 SPOKEN AND WRITTEN COMMUNICATION L T P C
0 0 4 2

OBJECTIVES

The objective of this course will enable students to:

- Familiarize learners with the mechanics of writing.
- Enable learners to improve their employability skills.
- Enable learners to enhance skills for work place communication.
- Write articles for publication and Carry out research analysis.
- Understand the requirement for effective media and creative writing.

UNIT I: PERSONAL COMMUNICATION 12

Day-to-day conversation with family members, neighbours, relatives, friends on various topics, context specific - Journal writing, mails/emails, SMS, greeting cards, situation based - accepting/declining invitations, congratulating, consoling, conveying information, oral reports, extempore.

UNIT II: EMPLOYABILITY SKILLS 12

Interview skills - HR and technical - Types of interview, preparation for interview, mock interview, Group Discussion - Communication skills in Group Discussion, Structure of GD, GD process, successful GD techniques. Time management and effective planning - identifying barriers to effective time management, time management techniques, relationship between time management and stress management.

UNIT III: WORK PLACE COMMUNICATION 12

E-mails, minutes, reports of different kinds - annual report, status report, survey report, proposals, memorandums, presentations, interviews, profile of institutions, speeches, responding to enquiries, complaints, resumes, applications, summarizing, strategies for writing.

UNIT IV: RESEARCH WRITING 12

Articles for publication (Journals), developing questionnaire, writing abstract, dissertation, qualities of research writing, data (charts, tables) analysis, documentation.

UNIT V: WRITING FOR MEDIA AND CREATIVE WRITING 12

Features for publication (Newspapers, magazines, newsletters, notice board), case studies, short stories, travelogues, writing for children, translation, techniques of writing.

TOTAL: 60 PERIODS

Note: It is an activity based course. Student individually or as a group can organize event(s), present term papers etc. This will be evaluated by the faculty member(s) handling the course and the consolidated marks can be taken as the final mark.

No end semester examination is required for this course.

OUTCOMES

Learners should be able to

- Get into the habit of writing regularly.
- Speak confidently with any speakers of English, including native speakers.
- Speak effortlessly in different contexts - informal and formal.
- Write articles, case studies and different kind stories.
- Express themselves in different genres of writing from creative to critical to factual writing.

TEXT BOOKS

1. Raymond V Lesikar, John D Pettit, and Mary E Flatly, 2009. Lesikar's Basic Business Communication, 11th ed. Tata McGraw-Hill, New Delhi.
2. E.H. McGrath, S.J. 2012, Basic Managerial Skills for All. 9th ed. Prentice-Hall of India, New Delhi.

REFERENCES

1. Richard Denny, 'Communication to Win; Kogan Page India Pvt. Ltd., New Delhi, 2008.
2. Dale Carnagie ,' The Quick and Easy Way to Effective Speaking' Amazing Reads, 2018.

E-RESOURCES

Blogs	: Seth Godwin, Guy Kawasaki, Kiruba Shankar
Review	: Harvard Business review
Reports	: Deloitte Netsis
Magazines	: Bloomberg Business week, Economist

SEMESTER II

21BAT201	APPLIED OPERATIONS RESEARCH	L T P C 3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the concepts of operations research applied in business decision making.
- Understand difference between balanced and unbalanced problems
- Know Integer programming and Game theory.
- Understand different models for inventory and decision making.
- Learn Queuing theory and replacement models.

UNIT I: INTRODUCTION TO LINEAR PROGRAMMING (LP) 9

Introduction to applications of operations research in functional areas of management. Linear Programming-formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases. Dual simplex method. Principles of Duality. Sensitivity Analysis.

UNIT II: LINEAR PROGRAMMING EXTENSIONS 9

Transportation Models (Minimising and Maximising Problems) - Balanced and unbalanced Problems - Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel"s approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Case of Degeneracy. Transhipment Models. Assignment Models (Minimising and Maximising Problems) -Balanced and Unbalanced Problems. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

UNIT III: INTEGER PROGRAMMING AND GAME THEORY 9

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms. Game Theory-Two person Zero sum games-Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and LP solutions.

UNIT IV: INVENTORY MODELS, SIMULATION AND DECISION THEORY 9

Inventory Models - EOQ and EBQ Models (With and without shortages), Quantity Discount Models. Decision making under risk - Decision trees - Decision making under uncertainty. Monte-carlo simulation.

UNIT V: QUEUING THEORY AND REPLACEMENT MODELS **9**

Queuing Theory - single and Multi-channel models - infinite number of customers and infinite calling source. Replacement Models-Individuals replacement Models (With and without time value of money) - Group Replacement Models.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.
- Know solutions for different kind of balanced and unbalanced problems.
- Know the solutions for pure and mixed integer programming problem.
- Understanding different kind of inventory models.
- Analyzing different kind of replacement models and queuing theory.

TEXT BOOKS

1. N. D Vohra, Quantitative Techniques in Management,Tata Mcgraw Hill, 2010
2. Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, 9 th Edition, 2010.

REFERENCES

1. Bernard W.Taylor, Introduction to Management Science, 12 th edition, 2012
2. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008

E-RESOURCES

1. https://www.shmula.com/queueing-theory(Queuing Theory)
2. https://businessjargons.com/linear-programming.html(Linear programming)

21BAT202 **BUSINESS RESEARCH METHODS** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Familiarize the students to the principles of scientific methodology in business enquiry.
- Impart knowledge and skills required for research designing and measurement.
- Understand the methods available for Data collection.
- Develop analytical skills of business research.
- Develop the skills for design and write research reports.

UNIT I: INTRODUCTION **9**

Business Research - Definition and Significance - the research process - Types of Research - Exploratory and causal Research - Theoretical and empirical Research - Cross -Sectional and time - series Research - Research questions / Problems - Research objectives - Research hypotheses - characteristics - Research in an evolutionary perspective - the role of theory in research.

UNIT II: RESEARCH DESIGN AND MEASUREMENT **9**

Research design - Definition - types of research design - exploratory and causal research design - Descriptive and experimental design - different types of experimental design - Validity of findings - internal and external validity - Variables in Research - Measurement and scaling - Different scales - Construction of instrument - Validity and Reliability of instrument.

UNIT III: DATA COLLECTION **9**

Types of data - Primary Vs Secondary data - Methods of primary data collection - Survey Vs Observation - Experiments - Construction of questionnaire and instrument - Validation of questionnaire - Sampling plan - Sample size - determinants optimal sample size - sampling techniques - Probability Vs Non-probability sampling methods.

UNIT IV: PREPARATION AND ANALYSIS **9**

Data Preparation - editing - Coding -Data entry - Validity of data - Qualitative Vs Quantitative data analyses - Bivariate and Multivariate statistical techniques - Factor analysis - Discriminant analysis - cluster analysis - multiple regression and correlation - multidimensional scaling - Conjoint Analysis - Application of statistical software for data analysis.

UNIT V: REPORT DESIGN, WRITING AND ETHICS IN BUSINESS RESEARCH **9**

Research report - Different types - Contents of report - need of executive summary - chapterization - contents of chapter - report writing - the role of audience - readability - comprehension - tone - final proof - report format - title of the report - ethics in research - ethical behaviour of research - subjectivity and objectivity in research.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Become acquainted with the scientific methodology in business domain.
- Become skillful for research design and measurement.
- Understanding the methods available for Data collection.
- Become skillful for Data preparation and analysis.
- Know to write report for business research.

TEXT BOOKS

1. Donald R. Cooper, Pamela S. Schindler and J K Sharma, Business Research methods, 11th Edition, Tata Mc Graw Hill, New Delhi, 2012.
2. William G Zikmund, Barry J Babin, Jon C.Carr, Atanu Adhikari,Mitch Griffin, Business Research methods, A South Asian Perspective, 8th Edition, Cengage Learning, New Delhi, 2012.

REFERENCES

1. Alan Bryman and Emma Bell, Business Research methods, 3rd Edition, Oxford University Press, New Delhi, 2011.
2. Uma Sekaran and Roger Bougie, Research methods for Business, 5th Edition, Wiley India, New Delhi, 2012.

E-RESOURCES

1. https://research-methodology.net/research-methods/data-collection/(DataCollectionmethods).
2. https://businessjargons.com/data-collection.html(Data collection)

21BAT203 **FINANCIAL MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the operational nuances of a Finance Manager.
- Comprehend the technique of making decisions related to Investment function.
- Comprehend the technique of making decisions related to financing and dividend decision.
- Understand concepts related to working capital management.
- Aware the sources available for long term finance.

UNIT I: FOUNDATIONS OF FINANCE **9**

Introduction to finance- Financial Management - Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions -Time value of money - features and valuation of shares and bonds - Concept of risk and return -single asset and of a portfolio.

UNIT II: INVESTMENT DECISIONS **9**

Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques Concept and measurement of cost of capital - Specific cost and overall cost of capital.

UNIT III: FINANCING AND DIVIDEND DECISION **9**

Leverages - Operating and Financial leverage - measurement of leverages - degree of Operating & Financial leverage - Combined leverage, EBIT - EPS Analysis- Indifference point. Capital structure - Theories - Net Income Approach, Net Operating Income Approach, MM Approach - Determinants of Capital structure.

Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theories - Walters - Model, Gordon's model and MM model. - Factors determining dividend policy - Types of dividend policies - forms of dividend.

UNIT IV: WORKING CAPITAL MANAGEMENT **9**

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management - Cash management - Working capital finance: Trade credit, Bank finance and Commercial paper

UNIT V: LONG TERM SOURCES OF FINANCE **9**

Indian capital and stock market, New issues market Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Possess the techniques of managing finance in an organization.
- Make decisions related to investment.
- Know the concepts related to finance and dividend decisions.
- Understanding the importance of working capital management.
- Know the sources available for long term finance.

TEXT BOOKS

1. I.M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 10th edition, 2012.
2. James C. Vanhorne -Fundamentals of Financial Management- PHI Learning, 11th Edition, 2012.

REFERENCES

1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 6th edition, 2011
2. Prasanna Chandra, Financial Management, 9th edition, Tata McGraw Hill, 2012

E-RESOURCES

1. www.economicsdiscussion.net/investment-decisions/investment-decisions.../21976(Investment decisions-Meaning,Need and Factors affecting it)
2. https://financial-dictionary.thefreedictionary.com/Investment+decisions(Investment Decisions)

21BAT204 **HUMAN RESOURCE MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide knowledge about evolution and importance of human resource management.
- Compliance with human resource requirements and forecasting.
- Understand methods available for training and development.
- Know compensation plan and career management.
- Aware performance evaluation and control process.

UNIT I: PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT **5**

Evolution of human resource management - The importance of the human factor - Challenges - Inclusive growth and affirmative action -Role of human resource manager - Human resource policies - Computer applications in human resource management - Human resource accounting and audit.

UNIT II: THE CONCEPT OF BEST FIT EMPLOYEE **8**

Importance of Human Resource Planning - Forecasting human resource requirement - matching supply and demand - Internal and External sources. Recruitment - Selection - induction - Socialization benefits.

UNIT III: TRAINING AND EXECUTIVE DEVELOPMENT **10**

Types of training methods -purpose- benefits- resistance. Executive development programmes -Common practices - Benefits - Self-development - Knowledge management.

UNIT IV: SUSTAINING EMPLOYEE INTEREST **12**

Compensation plan - Reward - Motivation - Application of theories of motivation - Career management - Development of mentor - Protégé relationships.

UNIT V: PERFORMANCE EVALUATION AND CONTROL PROCESS **10**

Method of performance evaluation - Feedback - Industry practices. Promotion, Demotion, Transfer and Separation - Implication of job change. The control process - Importance - Methods - Requirement of effective control systems grievances - Causes - Implications - Redressal methods.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Students will gain knowledge and skills needed for success as a human resources professional.
- Identify the sources available for recruitment.
- Know the methods of training and development programme available for self development.
- Understanding methods available for sustaining employee interest.
- Understanding performance evaluation system and control process.

TEXT BOOKS

1. Dessler Human Resource Management, Pearson Education Limited, 14th Edition,2015.
2. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHILearning. 2012

REFERENCES

1. Decenzo and Robbins, Fundamentals of Human Resource Management, Wiley, 11th Edition, 2013.
2. Bernadine, Human Resource Management, Tata Mcgraw Hill, 8th edition 2012.

E-RESOURCES

1. https://www.questionpro.com/blog/performance evaluation/(PerformanceEvaluation-Definition,Methods,Survey Questions and Examples)
2. https://www.scribd.com/doc/23262764/Unit-4-SustainingEmployee - Interest(Sustaining Employee Interest)

21BAT205 INFORMATION MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the importance of information in business.
- Know the technologies and methods used for system analysis and design.
- Understand different kind of database management system.
- Acquaint the learners to gain knowledge about security and control.
- Know emerging information technology initiative in business.

UNIT I: INTRODUCTION **10**

Data, Information, Intelligence, Information Technology, Information System, evolution, types based on functions and hierarchy, System development methodologies, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System.

UNIT II: SYSTEM ANALYSIS AND DESIGN **10**

Case tools - System flow chart, Decision table, Data flow Diagram (DFD), Entity Relationship (ER), Object Oriented Analysis and Design (OOAD), UML diagram.

UNIT III: DATABASE MANAGEMENT SYSTEMS **9**

DBMS - HDBMS, NDBMS, RDBMS, OODBMS, Query Processing, SQL, Concurrency Management, Data warehousing and Data Mart.

UNIT IV: SECURITY, CONTROL AND REPORTING **8**

Security, Testing, Error detection, Controls, IS Vulnerability, Disaster Management, Computer Crimes, Securing the Web, Intranets and Wireless Networks, Software Audit, Ethics in IT, User Interface and reporting.

UNIT V: NEW IT INITIATIVES **8**

Role of information management in ERP, e-business, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gains knowledge on effective applications of information systems in business.
- Gains knowledge on analysis of system and design.
- Understanding different kind of database management system.
- Aware vulnerability, problem and security measures available for information system.
- Discuss about emerging trends in Information Technology.

TEXT BOOKS

1. Gordon Davis, Management Information System: Conceptual Foundations, Structure and Development, Tata McGraw Hill, 21st Reprint 2008
2. Haag, Cummings and Mc Cubbrey, Management Information Systems for the Information Age,McGraw Hill, 2005. 9th edition, 2013

REFERENCES

1. James O Brien, Management Information Systems - Managing Information Technologyin the E-business enterprise, Tata McGraw Hill, 2004
2. Robert Schultheis and Mary Summer, Management Information Systems - The Managers View, Tata McGraw Hill, 2008

E-RESOURCES

1. https://www.ecampusnews.com/2017/01/25/strategies-tech-initiatives(8 strategie for successful tech initiatives)
2. https://www.tutorialspoint.com/system_analysis_and_design/system_design.html(System Analysis and Design –System Design)

21BAT206 **OPERATIONS MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide a broad introduction to the field of operations management and explain the concepts.
- Understand methods available to demand forecasting and capacity planning.
- Acquaint the learners to get knowledge about product design and issues.
- Aware about different concepts of material management.
- Understand the rules and techniques of project management and scheduling.

UNIT I: INTRODUCTION TO OPERATIONS MANAGEMENT **9**

Operations Management - Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy - Strategic fit , framework; Supply Chain Management.

UNIT II: FORECASTING, CAPACITY AND FACILITY DESIGN **9**

Demand Forecasting - Need, Types, Objectives and Steps. Overview of Qualitative and Quantitative methods. Capacity Planning - Long range, Types, Developing capacity alternatives. Overview of sales and operations planning. Overview of MRP, MRP II and ERP. Facility Location - Theories, Steps in Selection, Location Models. Facility Layout - Principles, Types, Planning tools and techniques.

UNIT III: DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS **9**

Product Design - Influencing factors, Approaches, Legal, Ethical and Environmental issues. Process - Planning, Selection, Strategy, Major Decisions. Work Study - Objectives, Procedure. Method Study and Motion Study. Work Measurement and Productivity - Measuring Productivity and Methods to improve productivity.

UNIT IV: MATERIALS MANAGEMENT **9**

Materials Management - Objectives, Planning, Budgeting and Control. Purchasing - Objectives, Functions, Policies, Vendor rating and Value Analysis. Stores Management - Nature, Layout, Classification and Coding. Inventory - Objectives, Costs and control techniques. Overview of JIT.

UNIT V: SCHEDULING AND PROJECT MANAGEMENT **9**

Project Management - Scheduling Techniques, PERT, CPM; Scheduling - work centers - nature, importance; Priority rules and techniques, shop floor control; Flow shop scheduling - Johnson"s Algorithm - Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understanding the role of operations management function in an organization.
- Identify the methods available to Forecasting and capacity planning.
- Know the factors influencing product design and process.
- Understanding the concept of material management.
- Understanding different techniques of Scheduling.

TEXT BOOKS

1. Chary S. N, Production and Operations Management, Tata McGraw Hill, 5th Edition,2013.
2. Aswathappa K and Shridhara Bhat K, Production and Operations Management, Himalaya Publishing House, Revised Second Edition, 2008.

REFERENCES

1. Norman Gaither and Gregory Frazier, Operations Management, South Western Cengage, 2002.
2. Russel and Taylor, Operations Management, Wiley, 8th Edition, 2015.

E-RESOURCES

1. https://www.studytonight.com/operating-system/process-scheduling(process scheduling)
2. www.materialsmanagement.info/defscope/index.html(materialsmanagement)

21BAT207 **MARKETING MANAGEMENT** **L T P C**
4 0 0 4

OBJECTIVES

The objective of this course will enable students to:

- Develop an understanding of ideas and nuances of modern marketing
- Describe the process to formulate and manage the B2B marketing strategy including all key components.
- Explain the techniques to conduct market analysis practices including market segmentation and targeting.
- Compare and contrast different perspectives that characterize the study of consumer behavior.
- Explain the role of IMC in the overall marketing program.

UNIT I: INTRODUCTION **12**

Marketing - Definitions - Conceptual frame work - Marketing environment : Internal and External - Marketing interface with other functional areas - Production, Finance, Human Relations Management, Information System. Marketing in global environment - Prospects and Challenges.

UNIT II: MARKETING STRATEGY **12**

Marketing strategy formulations - Key Drivers of Marketing Strategies - Strategies for Industrial Marketing - Consumer Marketing - Services marketing - Competitor analysis - Analysis of consumer and industrial markets - Strategic Marketing Mix components.

UNIT III: MARKETING MIX DECISIONS **12**

Product planning and development - Product life cycle - New product Development and Management - Market Segmentation - Targeting and Positioning - Channel Management - Advertising and sales promotions - Pricing Objectives, Policies and methods.

UNIT IV: BUYER BEHAVIOUR **12**

Understanding industrial and individual buyer behavior - Influencing factors - Buyer Behaviour Models - Online buyer behaviour - Building and measuring customer satisfaction - Customer relationships management - Customer acquisition, Retaining, Defection.

UNIT V: MARKETING RESEARCH & TRENDS IN MARKETING **12**

Marketing Information System - Research Process - Concepts and applications : Product - Advertising - Promotion - Consumer Behaviour - Retail research - Customer driven organizations - Cause related

- Ethics in marketing -Online marketing trends.

TOTAL: 60 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gain Knowledge of analytical skills in solving marketing related problems.
- Create awareness of marketing management process.
- Create awareness of marketing mix decisions.
- Understand the behavior of consumer.
- Know the recent trends in marketing and research.

TEXT BOOKS

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012
2. Micheal R.Czinkota & Masaaki Kotabe, Marketing Management, Cengage, 2000.

REFERENCES

1. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2nd Edition, 2011.
2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill, 1st , Edition, 2010.

E-RESOURCES

1. https://www.mymarketresearchmethods.com/the-market-research- (Market research process)
2. https://www.mbaskool.com› Concepts› Marketing and Strategy - (Marketing strategy-Meaning, Importance, Steps and stages, Examples)

21BAL201 DATA ANALYSIS AND BUSINESS MODELING L T P C
0 0 4 2

OBJECTIVES

The objective of this course will enable students to:

- Have hands-on experience on decision modeling.
- Acquire knowledge of sampling distribution and estimation.
- Provide information about Parametric tests.
- Test the hypothesis about the population using of and Chi-square test.
- Provide information about Estimation theory and Regression lines.
- Know about data analysis tools.

[Business models studied in theory to be practiced using Spreadsheet / Analysis Software]

S.No.	Exp. No.	Details of experiments	Duration
		Name	
1	1	Descriptive Statistics	4
2	2	Hypothesis - Parametric	4
3	3	Hypothesis – Non-parametric	4
4	4	Correlation & Regression	4
5	5	Forecasting	4
6	-	Extended experiment – 1	4
7	6	Portfolio Selection	4
8	7	Risk Analysis & Sensitivity Analysis	4
9	8	Revenue Management	4
10	-	Extended experiment – 2	4
11	9	Transportation & Assignment	4
12	10	Networking Models	4
13	11	Queuing Theory	4
14	12	Inventory Models	4
15	-	Extended experiments – 3	4

- Spreadsheet Software and
- Data Analysis Tools

TOTAL: 60 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Knowledge of spreadsheets and data analysis software for business modeling.
- Find the inference of the samples by using various methods in testing of hypothesis.
- Interpret variances by design of experiments to obtain inferences.
- Apply logical thinking and its applications.
- Conceptualize sequential structures, tree structures, and graph structures and its Applications.
- Familiarize with data analysis tools.

TEXT BOOKS

1. Hansa Lysander Manohar , " Data Analysis and Business Modelling using MS Excel",PHI Learning private Ltd, 2017.
2. David M. Levine et al, "Statistics for Managers using MS Excel" (6th Edition) Pearson, 2010

REFERENCES

1. Vikas Gupta, Comdex Business Accounting with Ms Excel, 2010 and Tally ERP 9.0 Course Kit, Wiley India, 2012.
2. Kiran Pandya and Smriti Bulsari, SPSS in simple steps, Dreamtech, 2011.

E-RESOURCES

1. https://en.wikipedia.org/wiki/Descriptive statistics(Descriptive Statistics)
2. https://study.com/academy/.../the-transportation-problem-features-types-solutions.html (Transportation Problem)

21BAE201 **CREATIVITY AND INNOVATION** **L T P C**
0 0 2 0

OBJECTIVES

The objective of this course will enable students to:

- Understand the nuances involved in Creativity & Innovation.
- Know the mechanism of thinking and visualization.
- Get hands on experience in applying creativity in problem solving.
- Understand role of creativity in problem solving.
- Acquire knowledge of innovation and its role.

UNIT I: INTRODUCTION **9**

Need for Creative and innovative thinking for quality — Essential theory about directed creativity, components of Creativity, Methodologies and approaches, individual and group creativity, organizational role in creativity, types of innovation, barriers to innovation, innovation process, establishing criterion for assessment of creativity & innovation.

UNIT II: MECHANISM OF THINKING AND VISUALIZATION **9**

Definitions and theory of mechanisms of mind heuristics and models : attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, color symmmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Visualization benchmarking

UNIT III: CREATIVITY **9**

Methods and tools for Directed Creativity – Basic Principles – Tools that prepare the mind for creative thought – stimulation – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – ApplyingDirected Creativity.

UNIT IV: CREATIVITY IN PROBLEM SOLVING **9**

Generating and acquiring new ideas, product design, service design – case studies and hands-on exercises, stimulation tools and approaches, six thinking hats, lateral thinking — Individual activity,group activity, contextual influences.

UNIT V: INNOVATION **9**

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving – the essential factors – Innovator's solution – creating and sustaining successful growth – DisruptiveInnovation model —

Segmentive Models – New market disruption - Commoditation and DE- commoditation – Managing the Strategy Development Process – The Role of Senior Executive in Leading NewGrowth — Passing the Baton

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Student will be equipped to apply his/her creative and innovative skills in solving complex problems confronting corporate realm.
- Discuss the mechanism of thinking and visualization.
- Understanding factors directed to creativity.
- Discuss the role creativity in problem solving.
- Understanding the methods available to achieving creativity.

TEXT BOOKS

1. Rousing Creativity: Think New Now Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999
2. Geoffrey Petty," how to be better at Creativity", The Industrial Society 1999

REFERENCES

1. Clayton M. Christensen Michael E. Raynor," The Innovator's Solution", Harvard Business School Press, Boston, USA, 2003
2. Semyon D. Savransky," Engineering of Creativity – TRIZ", CRC Press New York USA,"2000

SEMESTER III

21BAT301 INTERNATIONAL BUSINESS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Familiarize the students to the basic concepts of international business management.
- Understand International trade theories and organizations.
- Understand global portfolio management and different forms of business.
- Aware issues related to global production, marketing , finance and human resource.
- Discuss about conflict and ethics in International Business.

UNIT I: INTRODUCTION 6

International Business -Definition - Internationalizing business-Advantages - factors causing globalization of business- international business environment - country attractiveness -Political, economic and cultural environment - Protection Vs liberalization of global business environment.

UNIT II: INTERNATIONAL TRADE AND INVESTMENT 11

Promotion of global business - the role of GATT/WTO - multilateral trade negotiation and agreements - VIII & IX, round discussions and agreements - Challenges for global business - global trade and investment - theories of international trade and theories of international investment - Need for global competitiveness - Regional trade block - Types - Advantages and disadvantages - RTBs across the globe - brief history.

UNITIII: INTERNATIONALSTRATEGICMANAGEMENT 11

Strategic compulsions-Standardization Vs Differentiation - Strategic options - Global portfolio management- global entry strategy - different forms of international business - advantages - organizational issues of international business - organizational structures - controlling of international business - approaches to control - performance of global business- performance evaluation system.

UNIT IV: PRODUCTION, MARKETING, FINANCIAL AND HUMAN RESOURCE MANAGEMENT OF GLOBAL BUSINESS 11

Global production -Location -scale of operations- cost of production - Make or Buy decisions - global supply chain issues - Quality considerations- Globalization of markets, marketing strategy -Challenges in product development , pricing, production and channel management- Investment

decisions - economic- Political risk - sources of fund- exchange rate risk and management — strategic orientation - selection of expatriate managers- Training and development - compensation.

UNIT V: CONFLICT MANAGEMENT AND ETHICS IN INTERNATIONAL BUSINESS MANAGEMENT **6**

Disadvantages of international business - Conflict in international business- Sources and types of conflict - Conflict resolutions - Negotiation - the role of international agencies -Ethical issues in international business - Ethical decision-making.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Familiar with global business environment, global strategicmanagement practices.
- Aware international statutory bodies to regulate business.
- Gain knowledge about forms of business in global environment.
- Discuss issues in functional areas of business in global perspective.
- Familiar with conflicts situations and ethical issues in global business.

TEXT BOOKS

1. Charles W.I. Hill and Arun Kumar Jain, International Business, 6th edition, Tata McGraw Hill, New Delhi, 2010. Charles W.I. Hill and Arun Kumar Jain, International Business, 6th edition, Tata McGraw Hill, New Delhi, 2010.
2. John D. Daniels and Lee H. Radebaugh, International Business, Pearson Education Asia, Edition, New Delhi, 2010

REFERENCES

1. K. Aswathappa, International Business,6th Edition, Tata Mc Graw Hill, New Delhi, 2015.
2. Rakesh Mohan Joshi, International Business, Oxford University Press, New Delhi, 2009.

E-RESOURCES

1. https://www.investopedia.com/insights/what-is-international-trade(The Investors guide to international trade)
2. https://www.hrpersonality.com/resources/conflict-management-techniques - (Conflict Management Techniques)

21BAT302 STRATEGIC MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the Conceptual framework and vision and mission of an organization.
- Learn about External environment and Competitive advantage of an organizations.
- Know different kind of strategies of Domestic and global level.
- Gain knowledge about strategy implementation and its issues.
- Familiar with technology and innovation issues.

UNIT I: STRATEGY AND PROCESS 9

Conceptual framework for strategic management, the Concept of Strategy and the Strategy Formation Process - Stakeholders in business - Vision, Mission and Purpose - Business definition, Objectives and Goals - Corporate Governance and Social responsibility-case study.

UNIT II: COMPETITIVE ADVANTAGE 9

External Environment - Porter‟s Five Forces Model-Strategic Groups Competitive Changes during Industry Evolution-Globalisation and Industry Structure - National Context and Competitive advantage Resources- Capabilities and competencies-core competencies-Low cost and differentiation Generic Building Blocks of Competitive Advantage- Distinctive Competencies-Resources and Capabilities durability of competitive Advantage- Avoiding failures and sustaining competitive advantage-Case study.

UNIT III: STRATEGIES 10

The generic strategic alternatives - Stability, Expansion, Retrenchment and Combination strategies -Business level strategy- Strategy in the Global Environment-Corporate Strategy-Vertical Integration-Diversification and Strategic Alliances- Building and Restructuring the corporation- Strategic analysis and choice - Environmental Threat and Opportunity Profile (ETOP) - Organizational Capability Profile -Strategic Advantage Profile - Corporate Portfolio Analysis - SWOT Analysis - GAP Analysis - McKinsey's 7s Framework - GE 9 Cell Model - Distinctive competitiveness - Selection of matrix - Balance Score Card-case study.

UNIT IV: STRATEGY IMPLEMENTATION & EVALUATION 9

The implementation process, Resource allocation, Designing organisational structure-Designing Strategic Control Systems- Matching structure and control to strategy-Implementing Strategic change-Politics-Power and Conflict-Techniques of strategic evaluation & control-case study.

UNIT V: OTHER STRATEGIC ISSUES **8**

Managing Technology and Innovation-Strategic issues for Non Profit organisations. New Business Models and strategies for Internet Economy-case study

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Create knowledge and understanding of management concepts principles and skills.
- Understanding Core competencies and competitive advantage.
- Understanding different kind of strategy and Strategic analysis models.
- Able to discuss implementation and evaluation process.
- Discuss about New business models , non profit organizations and internet based economy.

TEXT BOOKS

1. Azhar Kazmi, Strategic Management and Business Policy, 3rd Edition, Tata McGraw Hill,2008
2. Hill. Strategic Management : An Integrated approach, Edition Wiley 2012.

REFERENCES

1. Hill. Strategic Management : An Integrated approach, Edition Wiley 2012.
2. John A.Parnell. Strategic Management, Theory and practice Biztantra 2012

E-RESOURCES

1. https://www.tutor2u.net/business/reference/competitive-advantage
2. https://www.strategicmanagementinsight.com › Topics(Resource based view)

21BAE301 **SUMMER TRAINING** **L T P C**
0 0 2 1

OBJECTIVES:

The main objective of this course is to,

- Understand the basic practices of an organization.
- Develop skills and get industrial knowledge which will help to understand what is actually happens in industry.
- Improve proper behavior of corporate life in industrial sector.
- Provide a platform for knowledge transmission beyond the class room.
- Prepare Training report and to face reviews and viva voce examination.

GUIDELINES

The student select a company approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive report after completing the summer training to the satisfaction of the supervisor. The progress of the summer training is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A summer training report is required at the end of the semester. The summer training work is evaluated based on oral presentation and the report jointly by the Project Coordinator and examiner constituted by the Head of the Department. The duration of the summer training is for four weeks.

TOTAL: 30 PERIODS

OUTCOMES

On Completion of the summer training work students will be able to

- Develop the skills to understand the basic practices of an organization.
- Enhance the ability to improve proper behavior of corporate life in industrial sector.
- Demonstrate the application of knowledge and skill sets acquired from the course and workplace in the assigned job function/s.
- Demonstrate the ability to harness resources by analysing challenges and considering opportunities.
- Prepare Training report and to face reviews and viva voce examination.

SEMESTER IV

21BAE401	**PROJECT WORK**	**L T P C** **0 0 24 12**

OBJECTIVES

The main objective of the course is to,

- Develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- Utilize new tools that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology

GUIDELINES

The student works on a topic approved by the Head of the Department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor.The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester.The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The duration of the summer training is for Nine weeks.

TOTAL: 360 PERIODS

OUTCOMES

On Completion of the project work students will be able to,

- Develop the ability to solve a specific problem till the successful solution of the same.
- Utilize new tools that contribute to obtain the solution.
- Test and validate the results obtained through conformance.
- Prepare project report and to face reviews and viva voce examination.
- Take up any challenging practical problems and find the solution by formulating proper methodology.

PROFESSIONAL ELECTIVE I to VI

21BATM01	BRAND MANAGEMENT	L T P C 3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the basic Principles of branding.
- Understand the key issues in crafting and evaluating brand strategies.
- Improve the skills in delivering persuasive brand presentations.
- Evaluate brand extension and its contribution to parent brand.
- Develop an understanding of brand equity and a range of performance related outcomes.

UNIT I: INTRODUCTION **8**

Basics Understanding of Brands - Definitions - Branding Concepts - Functions of Brand - Significance of Brands - Different Types of Brands - Co branding - Store brands.

UNIT II: BRAND STRATEGIES **10**

Strategic Brand Management process - Building a strong brand - Brand positioning - Establishing Brand values - Brand vision - Brand Elements - Branding for Global Markets - Competing with foreign brands

UNIT III: BRAND COMMUNICATIONS **8**

Brand image Building - Brand Loyalty programmes - Brand Promotion Methods - Role of Brand ambassadors, celebrities - On line Brand Promotions.

UNIT IV: BRAND EXTENSION **9**

Brand Adoption Practices - Different type of brand extension - Factors influencing Decision for extension - Re-branding and re-launching.

UNIT V: BRAND PERFORMANCE **10**

Measuring Brand Performance - Brand Equity Management - Global Branding strategies - Brand Audit - Brand Equity Measurement - Brand Leverage -Role of Brand Managers- Branding challenges & opportunities.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Have a solid understanding of the key „branding" concepts, methods and tools used by marketing practitioners.
- Confidently engage in and contribute to brand building projects, developments, and discussions.
- Familiarized in brand promotion methods and communications.
- extend the brands in the method of re-branding and re-launching.
- The students will able to measure the branding and to know the branding challenges and opportunities.

TEXT BOOKS

1. Kevin Lane Keller, Strategic Brand Management: Building, Measuring and Managing Brand Equity, Pearson, 4th Edition, 2013
2. Aker, David, Building Strong Brands, Simon and Schuster, 1995

REFERENCES

1. Kapferer J.N, Strategic Brand Management, 4th edition, Kogan Press, 2008
2. Moorthi YLR, Brand Management - I edition, Vikas Publishing House 2001

E-RESOURCES

1. https://stickybranding.com/how-to-measure-brand-performance (How to measure brand performance)
2. https://www.amplimark.com/brand-strategy(Brand strategy)

21BATM02 **SOCIAL MARKETING** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Compare the difference between social marketing and commercial marketing.
- Enhance Competiveness in Social Marketing by ethical values.
- Understand the 4 P's of Marketing and identify its importance.
- Social marketing plan Conduct a situational analysis with Critics of social marketing.
- Craft a positioning statement that will be used in your campaign and develop understanding of social Network sites, blogs.

UNIT I: INTRODUCTION **9**

Social marketing - Definition - Scope and concept - Evolution of Social marketing - Need for Social marketing - A comparative study between Commercial and Social marketing - Use of market research - social change tools - Factors influencing Social marketing - Challenges and opportunities.

UNIT II: SOCIAL MARKETING PROCESS AND PLANNING **9**

Introduction - Environment Monitoring - Social Class and self-efficacy - social capital - Social ecology -Advocacy - A global phenomenon - Social marketing Process - Stages - Ethical considerations. Planning - Formative Research in Social marketing. Analysis - Problem - Environment - Resource.

Segmentation - Motives and benefits - Sheth‟s and Frazier‟s attitude - behavior segmentation - Stage approach to segmentation - Selecting target audiences - Cross cultural targeting - cultural and individual tailoring.

UNIT III: SOCIAL MARKETING MIX **9**

Social marketing mix - policy - product - place - price - promotion - people - partnership. Rating & Reviews - Virtual world - Using media in social marketing - Importance - effectiveness of mass media in social marketing - Practical model for media use in social marketing - Advertisement -Publicity - Edutainment - Civic or Public - Choosing media & methods.

Role of media in social marketing campaigns - planning and developing Social media campaigning -Campaign vs Programme - Programme planning models - conceptual model Lawrence Green‟s PRECEDE-PROCEED model.

UNIT IV: ETHICAL ISSUES AND CHALLENGES **9**

Ethical principles - Codes of behaviour - Critics of social marketing - Critic of power imbalance in social marketing - Criticism of unintended consequences - Competition in social marketing- Definition -monitoring - countering competition - competition and principle of differential advantage - Internal competition.

UNIT V: TRENDS IN SOCIAL MARKETING **9**

Future of Social marketing - setting priorities in social marketing - Repositioning strategies- Future of Public sector - NGO - Private sector social marketing.

Social Media marketing - Importance - Big Brands & Small business - E mail marketing -Social Media Tools -Marketing with Social network sites, blogging, micro blogging, podcasting with Podomatic

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Apply Ethical Principles in Social Marketing.
- Rapidly evolving role in public relations, advertising, and marketing.
- Know social media marketing strategies for various types of industries.
- Students will Define target markets for specific social media platforms.
- Track progress in achieving social media goals with a powerful measurement tools.

TEXT BOOKS

1. Ro Donovan & Nadine Henley. (2011). Principles and Practice of Social Marketing- an international perspective. Cambridge University Press.
2. Kotler, P., Roberto, N., & Lee, N. (2008). Social Marketing - Influencing Behaviors forGood. (3rd ed.). Thousand Oaks, CA: Sage Publications, Inc.

REFERENCES

1. Hastings, G. Social Marketing: Why should the Devil Have All the Best Tunes, Routledge2013
2. Alan R. Andreasen ,'Social marketing in the 21st Century' sage Publication, 2012

E-RESOURCES

1. https://en.wikipedia.org/wiki/Social_marketing(Social Marketing)
2. https://www.marketing-schools.org/types-of-marketing/social-marketing.html (Social marketing)

21BATM03 CUSTOMER RELATIONSHIP MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the need and importance of maintaining a good customer relationship.
- Benefits of CRM to companies and customers.
- Learn how to implement CRM best structures and retention and business applications.
- The importance planning and implementation process in CRM.
- Familiarize the data warehousing and software packages with recent trends in CRM.

UNIT I: INTRODUCTION 9

Definitions - Concepts and Context of relationship Management - Evolution - Transactional Vs Relationship Approach - CRM as a strategic marketing tool - CRM significance to the stakeholders.Expectations analysis - Customer behavior in relationship perspectives; individual and group customer‟s - Customer life time value - Selection of Profitable customer segments.

UNIT II: UNDERSTANDING CUSTOMERS 9

Customer information Database - Customer Profile Analysis - Customer perception, Expectations analysis - Customer behavior in relationship perspectives; individual and group customer‟s - Customer life time value - Selection of Profitable customer segments.

UNIT III: CRM STRUCTURES 9

Elements of CRM - CRM Process - Strategies for Customer acquisition - Retention and Prevention of defection - Models of CRM - CRM road map for business applications.

UNIT IV: CRM PLANNING AND IMPLEMENTATION 9

Strategic CRM planning process - Implementation issues - CRM Tools- Analytical CRM - Operational CRM - Call center management - Role of CRM Managers.

UNIT V: TRENDS IN CRM 9

CRM Solutions - Data Warehousing - Data mining for CRM - an introduction to CRM software packages.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Apply the concept of CRM, the benefits delivered by CRM.
- Implement how CRM practices and technologies enhance the achievement of marketing,
- sales and service objectives throughout the customer life-cycle stages of customer, and acquisition, retention and development
- Preferences for the long-term sustainability of the Organizations and implementations.
- Implement various technological tools for data mining and also successful implementation of CRM

TEXT BOOKS

1. Francis Buttle, Customer Relationship Management: Concepts & Tools, Elsevier,2004..
2. G.Shainesh, Jagdish, N.Sheth, Customer Relationship Management A Strategic respective, Macmillan 2010 Customer Relationship Management, Wiley 2012

REFERENCES

1. Alok Kumar et al, Customer Relationship Management : Concepts and applications, Biztantra,2008
2. Kumar, Customer Relationship Management - A Database Approach, Wiley India, 2007.

E-RESOURCES

1. https://www.scribd.com/doc/86718107/5-Models-of-CRM)
2. https://www.projectguru.in/publications/customer-relationship-management - (The IDIC model of CRM)

21BATM04 **INTEGRATED MARKETING COMMUNICATION** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Introduce the basic concepts of advertising and sales promotion and how business organizations.
- Research and evaluate an organizations marketing and promotional situation in order.
- Develop effective communication strategies and programmes in sales promotion.
- Understand the industry and the players through the personal selling.
- Enable students to develop a promotional plan adapted to a specific organization through the publicity and public relations.

UNIT I: INTRODUCTION TO ADVERTISEMENT **9**

Concept -definition-scope-Objectives-functions-principles of advertisement - Social, Economic and Legal Implications of advertisements - setting advertisement objectives - Advertisement Agencies -Selection and remuneration - Advertisement campaigns - case studies.

UNIT II: ADVERTISEMENT MEDIA **9**

Media plan - Type and choice criteria - Reach and frequency of advertisements - Cost of advertisements - related to sales - Media strategy and scheduling. design and execution of advertisements -Message development - Different types of advertisements - Layout - Design appeal - Copy structure - Advertisement production - Print - Radio. T.V. and Web advertisements - Media Research - Testing validity and Reliability of ads - Measuring impact of advertisements - case studies.

UNIT III: SALES PROMOTION **9**

Scope and role of sale promotion - Definition - Objectives of sales promotion - sales promotion techniques - Trade oriented and consumer oriented. Sales promotion - Requirement identification -Designing of sales promotion campaign - Involvement of salesmen and dealers - Out sourcing sales promotion national and international promotion strategies - Integrated promotion - Coordination within the various promotion techniques - Online sales promotions-case studies.

UNIT IV: PERSONAL SELLING **9**

Introduction - Meaning - Functions- Personal selling process - Evaluation - Compensation - Motivation- Territory Management - Sales Report Preparation and Presentation- Ethical Issues.

UNIT V: PUBLICITY AND PUBLIC RELATIONS **9**

Introduction - Meaning - Objectives -Scope-Functions-integrating PR in to Promotional Mix-Marketing Public Relation function- Process of Public Relations-advantages and disadvantages of PR-Measuring the Effectiveness of PR- PR tools and techniques. Difference between Marketing, PR and Publicity -Social publicity - Web Publicity and Social media - Publicity Campaigns.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Insight into the importance of advertising and sales promotion campaigns planning.
- Be able to create an effective marketing communication plan to build brands.
- Be able to use marketing communications to promote causes, political candidates and deal with societal problems with online sales promotions.
- To understand the theory and techniques applicable to the major marketing Communication functions in order to evaluate a company's marketing and promotional activities.
- Situation and tie this to company business goals and publicity.

TEXT BOOKS

1. Wells, Moriarty & Burnett, Advertising, Principles & Practice, Pearson Education, 7th Edition, 2007.
2. Kenneth Clow.Donald Baack ,Integrated Advertisements, Promotion and Marketing communication, Prentice Hall of India, New Delhi, 3rd Edition, 2006.

REFERENCES

1. S. H. H. Kazmi and Satish K Batra, Advertising & Sales Promotion, Excel Books, New Delhi, 3rd Revised edition edition, 2008.
2. George E Belch and Michel A Belch, Advertising & Promotion,TataMcGraw Hill, 10th edition, 2014

E-RESOURCES

1. https://www.toppr.com/guides/business-studies/marketing/personal-selling(Personal selling)
2. www.businessmanagementideas.com/advertisement(Copy testing methods)

21BATM05 **RETAIL MARKETING** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the concepts of effective retailing with challenges and opportunities.
- To familiarize the students regarding various dimensions of organized retail marketing.
- To develop practical understanding among the students associated with retailing.
- To develop transferrable skills for managing retail operation efficiently.
- To provide brief insight about floor operation, product display, product handling, inventory management and retail sale

UNIT I: INTRODUCTION **9**

An overview of Global Retailing - Challenges and opportunities - Retail trends in India - Socio economic and technological Influences on retail management - Government of India policy implications on retails

UNIT II: RETAIL FORMATS **9**

Organized and unorganized formats - Different organized retail formats - Characteristics of each format - Emerging trends in retail formats - MNC's role in organized retail formats

UNIT III: RETAILING DECISIONS **9**

Choice of retail locations - internal and external atmospherics - Positioning of retail shops - Building retail store Image - Retail service quality management - Retail Supply Chain Management - Retail Pricing Decisions. Mercandising and category management - buying.

UNIT IV: RETAIL SHOP MANAGEMENT **9**

Visual Merchandise Management - Space Management - Retail Inventory Management - Retail accounting and audits - Retail store brands - Retail advertising and promotions - Retail Management Information Systems - Online retail - Emerging trends..

UNIT V: RETAIL SHOPPER BEHAVIOUR **9**

Understanding of Retail shopper behavior - Shopper Profile Analysis - Shopping Decision Process -Factors influencing retail shopper behavior - Complaints Management - Retail sales force Management - Challenges in Retailing in India.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Manage the retail chains and understand the retail customer's behavior.
- Understand the Organized retail sector and its operations.
- Understand the various strategies involved with the retail sector.
- Learn how to deal with customers and understand their needs to sustain in the market.
- Understanding how to manage retail during crisis.

TEXT BOOKS

1. Chetan Bajaj, Rajnish Tow and Nidhi V. Srivatsava, Retail Management, Oxford UniversityPress, 3rd Edition 2016.
2. Swapna Pradhan, Retail Management -Text and Cases, Tata McGraw Hill, 4th Edition, 2012.

REFERENCES

1. Dr.Harjit Singh, Retail Management A Global Perspective, S.Chand Publishing, 3rd Edition,2014
2. Michael Havy ,Baston, Aweitz and Ajay Pandit, Retail Management, Tata Mcgraw Hill, Sixth Edition, 2007

E-RESOURCES

1. https://www.managementstudyguide.com/retail-formats(Retail formats)
2. www.authorstream.com/.../kalapriya61091-1611506-retail-shopperbehavior(RetailBehaviourtechniques)

21BATM06 **SERVICES MARKETING** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- The objective of this course is to supplement basic marketing and marketing strategy.
- Focusing on problems and strategies specific to marketing of targeting and positioning.
- Make the students to Understand the SERVAUAL and GAP model.
- Unique challenges of marketing and managing services, promoting and delivering quality service to customers.
- The attraction, retention, and building of strong customer relationships through quality service and services are at the heart of the course content.

UNIT I: INTRODUCTION **9**

Definition - Service Economy - Evolution and growth of service sector - Nature and Scope of Services - Unique characteristics of services - Challenges and issues in Services Marketing.

UNIT II: SERVICE MARKETING OPPORTUNITIES **9**

Assessing service market potential - Classification of services - Expanded marketing mix - Service marketing - Environment and trends - Service market segmentation, targeting and positioning.

UNIT III: SERVICE DESIGN AND DEVELOPMENT **9**

Service Life Cycle - New service development - Service Blue Printing - GAP model of service quality - Measuring service quality - SERVQUAL - Service Quality function development.

UNIT IV: SERVICE DELIVERY AND PROMOTION **9**

Positioning of services - Designing service delivery System, Service Channel - Pricing of services, methods - Service marketing triangle - Integrated Service marketing communication.

UNIT V: SERVICE STRATEGIES **9**

Service Marketing Strategies for health - Hospitality - Tourism - Financial - Logistics - Educational -Entertainment & public utility Information technique Services.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Apply the concepts of services marketing in promoting services.
- Examine the nature of services, and distinguish between products and services
- Develop an understanding of the roles of relationship marketing and customer service
- Appraise the nature and development of a services marketing strategy, delivery and promotion.
- Recognize how services marketing principles can be used as a conceptual framework to help managers identify and solve marketing problems and service strategies.

TEXT BOOKS

1. Valarie Zeithaml et al, Services Marketing, 5th International Edition, Tata McGraw Hill, 2007.
2. Chiristropher H.Lovelock and Jochen Wirtz, Services Marketing, Pearson Education, New Delhi, 7th edition, 2011.

REFERENCES

1. Hoffman, Marketing of Services, Cengage, 4th Edition, 2010.
2. Kevin Lane Keller, Strategic Brand Management: Building, Measuring and Managing Brand Equity, Pearson, 4th Edition, 2013.

E-RESOURCES

1. https://www.managementstudyguide.com/definition-and-characteristics-of-services.html/ (Definition of services)
2. https://www.marketingteacher.com/introduction-to-services-marketing (Introduction to services marketing)

21BATF01 STRATEGIC INVESTMENT AND FINANCING DECISION L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Acquiring knowledge in investment to overcome the risk analysis.
- Analyze investment decision under different capital constraints.
- Acquire techniques of evaluating strategic investment decisions understand the causes of prediction modes of financial distress.
- Gain a practical knowledge in obtaining capital structure.
- Develop analytical skills for settlements and reorganization.

UNIT I: INVESTMENT DECISIONS 9

Project Investment Management Vs Project Management - Introduction to profitable projects - evaluation of Investment opportunities - Investment decisions under conditions of uncertainty - Risk analysis in Investment decision - Types of investments and disinvestments.

UNIT II: CRITICAL ANALYSIS OF APPRAISAL TECHNIQUES 10

Significance of Information and data bank in project selections - Investment decisions under capital constraints - capital rationing, Portfolio - Portfolio risk and diversified projects.

UNIT III: STRATEGIC ANALYSIS OF SELECTED INVESTMENT DECISIONS 10

Lease financing - Lease Vs Buy decision - Hire Purchase and installment decision - Hire Purchase Vs Lease Decision - Mergers and acquisition - Cash Vs Equity for mergers.

UNIT IV: FINANCING DECISIONS 8

Capital Structure - Capital structure theories - Capital structure Planning in Practice

UNIT V: FINANCIAL DISTRESS 8

Consequences, Issues, Bankruptcy, Settlements, reorganization and Liquidation in bankruptcy.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Enumerate various Investment decisions in risk and uncertainty.
- Familiarized the concept of investment decisions under different capital constraints.
- Possess good knowledge in techniques for making strategic investment decision.
- Express the concepts of capital structure.
- Familiarized the concept in tackling financial distress

TEXT BOOKS

1. Prasanna Chandra, Financial Management, Tata McGraw Hill, 9th Edition, 2012
2. I.M. Pandey, Financial Management, Vikas Publishing House, 10th edition, 2010

REFERENCES

1. Bodie, Kane, Marcus: Investment, Tata McGraw Hill, New Delhi, 2010
2. M. Y. Khan and P. K. Jain, Financial Management Text and Problems, Tata McGraw HillPublishing Co, 2011.

E-RESOURCES

1. https://www.investopedia.com/terms/c/capitalstructure.asp (Capital structure)
2. https://www.investopedia.com/terms/b/bankruptcy.asp(Bankruptcy)

21BATF02 **CORPORATE FINANCE** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the significance of various sources of finance.
- Acquire nuances involved in short term corporate financing.
- Know the advanced methods in financial management.
- Attain knowledge in decisions involved in financing techniques.
- Acquire Good ethical practices.

UNIT I: INDUSTRIAL FINANCE **9**

Indian Capital Market - Basic problem of Industrial Finance in India. Equity - Debenture financing - Guidelines from SEBI, advantages and disadvantages and cost of various sources of Finance -Finance from international sources, financing of exports - role of EXIM bank and commercial banks. - Finance for rehabilitation of sick units.

UNIT II: SHORT TERM-WORKING CAPITAL FINANCE **6**

Estimating working capital requirements - Approach adopted by Commercial banks, Commercial paper- Public deposits and inter corporate investments.

UNIT III: ADVANCED FINANCIAL MANAGEMENT **12**

Appraisal of Risky Investments - certainty equivalent of cash flows and risk adjusted discount rate-risk analysis in the context of DCF methods using Probability information - nature of cash flows Sensitivity analysis - Simulation and investment decision, Decision tree approach in investment decisions.

UNIT IV: FINANCING DECISION **10**

Simulation and financing decision - cash inadequacy and cash insolvency - determining the probability of cash insolvency- Financing decision in the Context of option pricing model and agency costs- Inter-dependence of investment- financing and Dividend decisions.

UNIT V: CORPORATE GOVERNANCE **8**

Corporate Governance - SEBI Guidelines- Corporate Disasters and Ethics-Corporate Social Responsibility- Stakeholders and Ethics- Ethics, Managers and Professionalism.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Be a Good ethical corporate manager.
- Identify the key themes in Industrial Finance.
- Enables them in long term and short term financing decision of the business.
- Demonstrate the importance of financial management.
- Evaluate investment decision to maximize the value of the firm.

TEXT BOOKS

1. I.M.Pandey, Financial Management, Vikas Publishing House Pvt., Ltd., 12th Edition,2012
2. Richard A.Brealey, Stewat C.Myers and Mohanthy, Principles of Corporate Finance, TataMcGraw Hill, 9th Edition, 2011

REFERENCES

1. M.Y Khan, Indian Financial System, Tata McGraw Hill, 6th Edition, 2011
2. Madura, International Corporate Finance, 10th edition, Cengage Learning, 2014

E-RESOURCES

1. https://en.wikipedia.org/wiki/Corporate_finance(Corporate Finance)
2. https://corporatefinanceinstitute.co(Financeskillsfortherealworld)

21BATF03 **DERIVATIVES MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the nuances involved in derivatives.
- Gain an in-depth knowledge about future contract.
- Empower the knowledge of options.
- Equip the facts about SWAP.
- Understand the basic operational mechanisms in derivatives.

UNIT I: INTRODUCTION **9**

Derivatives - Definition - Types - Forward Contracts - Futures Contracts - Options - Swaps - Differences between Cash and Future Markets - Types of Traders - OTC and Exchange Traded Securities - Types of Settlement - Uses and Advantages of Derivatives - Risks in Derivatives.

UNIT II: FUTURES CONTRA **9**

Specifications of Futures Contract - Margin Requirements - Marking to Market - Hedging uses Futures - Types of Futures Contracts - Securities, Stock Index Futures, Currencies and Commodities - Delivery Options - Relationship between Future Prices, Forward Prices and Spot Prices.

UNIT III: OPTIONS **9**

Definition - Exchange Traded Options, OTC Options - Specifications of Options - Call and Put Options - American and European Options - Intrinsic Value and Time Value of Options - Option payoff, options on Securities, Stock Indices, Currencies and Futures - Options pricing models - Differences between future and Option contracts.

UNIT IV: SWAPS **9**

Definition of SWAP - Interest Rate SWAP - Currency SWAP - Role of Financial Intermediary - Warehousing - Valuation of Interest rate SWAPs and Currency SWAPs Bonds and FRNs - Credit Risk.

UNIT V: DERIVATIVES IN INDIA **9**

Evolution of Derivatives Market in India - Regulations - Framework - Exchange Trading in Derivatives - Commodity Futures - Contract Terminology and Specifications for Stock Options and Index Options in NSE - Contract Terminology and specifications for stock futures and Index futures in NSE - Contract Terminology and Specifications for Interest Rate Derivatives.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Obtain good knowledge about concepts of Derivatives.
- Analyze critical thinking, problem solving skills in the context of Hedging.
- Demonstrate an understanding of pricing forwards and options.
- Familiarized in interest rate and currency swaps.
- Providing an in-depth understanding of financial derivatives in terms of concepts, structure, instruments and trading strategies for profit and risk management.

TEXT BOOKS

1. David Dubofsky - „Option and Financial Futures - Valuation and Uses, McGraw Hill International Edition.
2. John. C. Hull, Options, Futures and Other Derivative Securities", PHI Learning, 9th Edition, 2012.

REFERENCES

1. S. L. Gupta, Financial Derivatives- Theory, Concepts and Practice, Prentice Hall of India, 2011.
2. Varma, Derivatives and Risk Management, 2nd Edition, 2011.

E-RESOURCES

1. https://www.indiainfoline.com/derivative-market-guide/what-are-exchange-traded-derivatives (Exchange traded in derivatives)
2. https://efinancemanagement.com/derivatives(Derivatives)

21BATF04 MERCHANT BANKING AND FINANCIAL SERVICES L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Obtain knowledge in SEBI and Merchant Banking.
- Understand the modes of issuing securities.
- Develop fee based services in Merchant Banking.
- Acquire financial evaluation technique of leasing and hire purchase.
- Learn the concepts of various fund based services in finance.

UNIT I: MERCHANT BANKING **5**

Introduction - An Over view of Indian Financial System - Merchant Banking in India - Recent Developments and Challenges ahead - merchant banking services offered by banks - NBFC"S offering merchant banking - Banking system - types of banks - payment banking -Legal and Regulatory Framework - Relevant Provisions of Companies Act- SERA- SEBI guidelines- FEMA, etc. - Relation with Stock Exchanges and OTCEI.

UNIT II: ISSUE MANAGEMENT **12**

Role of Merchant Banker in Appraisal of Projects, Designing Capital Structure and Instruments - Issue Pricing - Book Building - Preparation of Prospectus Selection of Bankers, Advertising Consultants, etc. - Role of Registrars -Bankers to the Issue, Underwriters, and Brokers. - Offer for Sale - Green Shoe Option - E-IPO, Private Placement - Bought out Deals - Placement with FIs, MFs, FIIs, etc. Off - Shore Issues. - Issue Marketing - Advertising Strategies - NRI Marketing -Post Issue Activities.

UNIT III: OTHER FEE BASED SERVICES **10**

Mergers and Acquisitions - Portfolio Management Services - Credit Syndication - Credit Rating - Mutual Funds - Business Valuation.

UNIT IV: FUND BASED FINANCIAL SERVICES **10**

Leasing and Hire Purchasing - Basics of Leasing and Hire purchasing - Financial Evaluation.

UNIT V: OTHER FUND BASED FINANCIAL SERVICES **8**

Consumer Credit - Credit Cards - Real Estate Financing - Bills Discounting - factoring and Forfeiting - Venture Capital - venture debt funds - start up financing.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Acquired good knowledge on merchant banking activities.
- Have a broad understanding about issue marketing.
- Gain knowledge about mutual funds.
- Access depth evaluation in leasing and Hire purchasing.
- Familiarized with concepts of service factoring.

TEXT BOOKS

1. Nalini Prava Tripathy, Financial Services, PHI Learning, 2011.
2. Machiraju, Indian Financial System, Vikas Publishing House, 2nd Edition, 2010.

REFERENCES

1. Sasidharan, Financial Services and System, Tata Mcgraw Hill, New Delhi, 2nd Edition, 2011.
2. Madura, Financial Institutions & Markets, 10th edition, Cengage, 2016.

E-RESOURCES

1. https://www.investopedia.com/terms/v/venturecapital.asp(Venture Capital)
2. https://businessjargons.com/merchant-banking.html(MerchantBanking)

21BATF05 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Acquire the knowledge in evaluating the concept of investment.
- Understand the techniques involved in deciding upon purchase or sale of securities.
- Acquire forecast techniques in economic and industry analysis.
- Gain profit from trading by observing various marketing patterns.
- Improve the overall proficiency of the portfolio.

UNIT I: INVESTMENT SETTING **8**

Financial and economic meaning of Investment - Characteristics and objectives of Investment - Types of Investment - Investment alternatives - Choice and Evaluation - Risk and return concepts.

UNIT II: SECURITIES MARKETS **10**

Financial Market - Segments - Types - - Participants in financial Market- Regulatory Environment, Primary Market - Methods of floating new issues, Book building - Role of primary market - Regulation of primary market, Stock exchanges in India - BSE, OTCEI , NSE, ISE, and Regulations of stock exchanges - Trading system in stock exchanges -SEBI.

UNIT III: FUNDAMENTAL ANALYSIS **9**

Economic Analysis - Economic forecasting and stock Investment Decisions - Forecasting techniques. Industry Analysis : Industry classification, Industry life cycle - Company Analysis Measuring Earnings - Forecasting Earnings - Applied Valuation Techniques - Graham and Dodds investor ratios.

UNIT IV: TECHNICAL ANALYSIS **9**

Fundamental Analysis Vs Technical Analysis - Charting methods - Market Indicators. Trend - Trend reversals - Patterns - Moving Average - Exponential moving Average - Oscillators -Market Indicators - Efficient Market theory.

UNIT V: PORTFOLIO MANAGEMENT **9**

Portfolio analysis - Portfolio Selection -Capital Asset Pricing model - Portfolio Revision Portfolio Evaluation - Mutual Funds.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Become a good investment analyst.
- Scrutinized the concept of investment opportunities in stock market.
- Equipped with the knowledge of fundamental analysis.
- Evaluate the indicator methods involved in various technical analysis.
- Analyze and evaluate the portfolio management for better investment.

TEXT BOOKS

1. Reilly & Brown, Investment Analysis and Portfolio Management, Cengage, 10th edition,2016
2. S. Kevin, Securities Analysis and Portfolio Management , PHI Learning , 2012.

REFERENCES

1. Donald E.Fischer & Ronald J.Jordan, Security Analysis & Portfolio Management, PHI Learning., New Delhi, 8th edition, 2011
2. Prasannachandra, Investment analysis and Portfolio Management, Tata McGraw Hill,2011

E-RESOURCES

1. https://nptel.ac.in/courses/110105035/(Introduction to investment management)
2. https://www.worldscientific.com/worldscibooks/10.1142/8116(Security analysis, Portfoliomanagement and financial derivatives)

21BATF06 **INTERNATIONAL TRADE FINANCE** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Know the concepts of international trade.
- Understand export import finance.
- Gain knowledge in forex management.
- Understand the documentation involved in international trade.
- Know the various promotion schemes involved in export.

UNIT I: INTERNATIONAL TRADE **9**

International Trade – Meaning and Benefits – Basis of International Trade –Foreign Trade andEconomic Growth — Balance of Trade — Balance of Payment — Current Trends in India —Barriers to International Trade – WTO – Indian EXIM Policy.

UNIT II: EXPORT AND IMPORT FINANCE **9**

Special need for Finance in International Trade – INCO Terms (FOB, CIF, etc.,) – PaymentTerms — Letters of Credit — Pre Shipment and Post Shipment Finance — Fortfaiting —Deferred Payment Terms – EXIM Bank – ECGC and its schemes Import Licensing – Financing methodsfor import of Capital goods.

UNIT III: FOREX MANAGEMENT **9**

Foreign Exchange Markets – Spot Prices and Forward Prices – Factors influencing Exchange rates – The effects of Exchange rates in Foreign Trade – Tools for hedging against Exchange rate variations – Forward, Futures and Currency options – FEMA – Determination of Foreign Exchange rate and Forecasting.

UNIT IV: DOCUMENTATION IN INTERNATIONAL TRADE **9**

Export Trade Documents: Financial Documents — Bill of Exchange- Type- Commercial Documents - Proforma, Commercial, Consular, Customs, Legalized Invoice, Certificate of OriginCertificate Value, Packing List, Weight Certificate, Certificate of Analysis and Quality, Certificate of Inspection, Health certificate. Transport Documents -Bill of Lading, Airway Bill, Postal Receipt, Multimodal Transport Document. Risk Covering Document: Insurance Policy, Insurance Cover Note. Official Document: Export Declaration Forms, GR Form, PP Form, COD Form, Softer Forms, Export Certification, GSPS — UPCDC Norms.

UNIT V: EXPORT PROMOTION SCHEMES **9**

Government Organizations Promoting Exports – Export Incentives : Duty Exemption – IT Concession – Marketing Assistance – EPCG, DEPB – Advance License – Other efforts I ExportPromotion – EPZ – EQU – SEZ and Export House.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Familiarized with international trade.
- Acquired knowledge about export and import in trade.
- Equipped with Spot Prices and Forward Prices.
- Possess good knowledge on international trade and the documentation involved in it.
- Learned the various concepts of export promotion scheme.

TEXT BOOKS

1. Apte P.G. International Fianacial Management, Tata Mcgraw Hill,2011
2. Jeff Madura, International Corporate Finance, Cengage Learning, 9th Edition, 2011.

REFERENCES

1. Alan C. Shapiro, Multinational Financial Management, PHI Learning, 5th Edition, 2010.
2. Eun and Resnik, International Financial Management, Tata Mcgraw Hill, 5th Edition, 2011

E-RESOURCES

1. https://corporatefinanceinstitute.com/resources/knowledge/tradinginvesting/spot- price/(Spot price)
2. https://nptel.ac.in/courses/110105035/(Risk and return)

21BATH01 ENTREPRENEURSHIP DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Impart basic entrepreneurial skills and understandings to run a business efficiently and effectively.
- Acquire knowledge about entrepreneurship development training and other support organizational services.
- Prefeasibility Study of business plan preparation.
- Gain knowledge about IT startups.
- Evaluate the Effective Management of small Business.

UNIT I: ENTREPRENEURAL COMPETENCE 6

Entrepreneurship concept - Entrepreneurship as a Career - Entrepreneurial Personality - Characteristics ofSuccessful, Entrepreneur - Knowledge and Skills of Entrepreneur.

UNIT II: ENTREPRENEURAL ENVIRONMENT 12

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations - International Business.

UNIT III: BUSINESS PLAN PREPARATION 12

Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria.

UNIT IV: LAUNCHING OF SMALL BUSINESS 10

Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection -Growth Strategies - Product Launching - Incubation, Venture capital, IT startups.

UNIT V: MANAGEMENT OF SMALL BUSINESS 5

Monitoring and Evaluation of Business - Preventing Sickness and Rehabilitation of Business Units-Effective Management of small Business.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Develop and strengthen entrepreneurial quality and motivation in students.
- Possess good knowledge in international business.
- Know about the budgeting project profile preparation.
- Gain knowledge and skills needed to run a business.
- Prevent sickness and rehabilitation of businessunits.

TEXT BOOKS

1. S.S.Khanka,Entrepreneurial Development, S.Chand and Company Limited,NewDelhi,(Revised Edition) 2013
2. Hisrich, Entrepreneurship, Edition 9, Tata McGraw Hill, New Delhi, 2014

REFERENCES

1. Prasanna Chandra, Projects - Planning, Analysis, Selection, Implementation andReviews,Tata McGraw-Hill, 1996
2. P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai 1997

E-RESOURCES

1. https://www.toppr.com/guides/business-environment/(Business environment)
2. ncert.nic.in/ncerts/l/lebs213.pdf(Entrepreneurship Development)

21BATH02 INDUSTRIAL RELATIONS AND LABOUR WELFARE L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Explore contemporary knowledge gain a conceptual understanding of industrial relations.
- Scrutinize the concepts of industrial disputes.
- Gain knowledge about welfare measures.
- Interpret the safety provisions in industry.
- Familiarize with the concept of special categories of labor welfare.

UNIT I: INDUSTRIAL RELATIONS **7**

Concepts - Importance - Industrial Relations problems in the Public Sector - Growth of Trade Unions - Codes of conduct.

UNIT II: INDUSTRIAL CONFLICTS **12**

Disputes - Impact - Causes - Strikes - Prevention - Industrial Peace - Government Machinery -Conciliation - Arbitration - Adjudication.

UNIT III: LABOUR WELFARE **8**

Concept - Objectives - Scope - Need - Voluntary Welfare Measures - Statutory Welfare Measures - Labour - Welfare Funds - Education and Training Schemes.

UNIT IV: INDUSTRIAL SAFETY **9**

Causes of Accidents - Prevention - Safety Provisions - Industrial Health and Hygiene - Importance - Problems - Occupational Hazards - Diseases - Psychological problems - Counseling - Statutory Provisions.

UNIT V: WELFARE OF SPECIAL CATEGORIES OF LABOUR **9**

Child Labour - Female Labour - Contract Labour - Construction Labour - Agricultural Labour - Differently abled Labour -BPO & KPO Labour - Social Assistance - Social Security - Implications.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Know how to resolve industrial relations and human relations problems.
- Expertised to overcome the industrial conflicts.
- Understand about the education and training schemes for labor welfare
- Overcome occupational Hazards in industry.
- Promote welfare of industrial labour.

TEXT BOOKS

1. Ratna Sen, Industrial Relations in India, Shifting Paradigms, Macmillan India Ltd., New Delhi, 2007
2. C.S.Venkata Ratnam, Globalisation and Labour Management Relations, ResponseBooks, 2007

REFERENCES

1. P.R.N Sinha, Indu Bala Sinha, Seema Priyardarshini Shekhar. Industrial Relations,Trade Unions and Labour Legislation. Pearson. 2004
2. Srivastava, Industrial Relations and Labour laws, Vikas, 2007.

E-RESOURCES

1. https://labour.gov.in/industrial-relations/ (industrial-relations)
2. cde.annauniv.edu/MBAQP/pdf/Elective/DBA1748/MBA%201748.pdf/ (University question paper)

21BATH03 **LABOUR LEGISLATIONS** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Have a broad understanding of the legal principles governing the employment relationshipat individual and collective level.
- Familiarize the students to the practical problems inherent in the implementation of labour statutes.
- Familiarize the students to the Employee Compensation Policy.
- Familiarize the students to the Social Benefits for Employees.
- Familiarize the students to the law relate to Child Labour.

Contained in the following acts are to be studied.	Periods
1. The Factories Act, 1948	3
2. The Trade Unions Act, 1926	4
3. The Payment of Wages Act, 1936	3
4. The Minimum Wages Act, 1948	2
5. The Industrial Disputes Act, 1947	5
6. The Workmen"s Compensation Act, 1923	2
7. The Payment of Gratuity Act, 1972	3
8. The Payment of Bonus Act, 1965	3
9. The Employee"s Provident Fund & Misc. Act, 1952	4
10. The Employees State Insurance Act, 1948	3
11. The Industrial Employment (Standing Orders) Act, 1946	3
12. The Apprentices Act, 1961	2
13. The Equal Remuneration Act, 1976	2
14. The Maternity Benefit Act, 1961	2
15. Contract Labour Regulations and Abolition Act, 1970	2
16. The Child Labour Prevention and Regulation Act, 1986	2

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Appreciate the application of labour laws.
- Legal Provision relating to
  1) Wages
  2) Working Conditions and Labour Welfare
  3) Industrial Relations
  4) Social Security
  5) Child labor.

TEXT BOOKS

1. Arun Monappa, Ranjeet Nambudiri, Patturaja Selvaraj. Industrial relations & Labour Laws.TataMcGraw Hill. 2012
2. D. R. N. Sinha, Indu Balasinha & Semma Priyadarshini Shekar, Industrial Relation TradeUnion and Labour Legislation, 200

REFERENCES

1. Kapoor N. D , Elements of Mercantile Law, Sultan Chand, 2008
2. P.K. Padhi, Industrial Laws, PHI, 2008

E-RESOURCES

1. https://www.britannica.com/topic/labour-law(labour-law)
2. https://www.educationobserver.com/forum/showthread.php?tid=16322(Labour legislation)

21BATH04 MANAGERIAL BEHAVIOUR AND EFFECTIVENESS L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Assess different systems of management and relate these systems to organizational characteristics.
- Understand the performance appraisal measures.
- Know the current Industrial and Government practices in the Management of Managerial Effectiveness.
- Examine managerial styles in terms of concern for production and concern for people.
- Fostering the Creativity and innovation in managerial effectiveness.

UNIT I: DEFINING THE MANAGERIAL JOB 8

Descriptive Dimensions of Managerial Jobs - Methods - Model - Time Dimensions in Managerial Jobs - Effective and Ineffective Job behaviour - Functional and level differences in Managerial Job behavior.

UNIT II: DESIGNING THE MANAGERIAL JOB 12

Identifying Managerial Talent - Selection and Recruitment - Managerial Skills Development - Pay and Rewards - Managerial Motivation - Effective Management Criteria - Performance Appraisal Measures - Balanced Scorecard - Feedback - Career Management - Current Practices.

UNIT III: THE CONCEPT OF MANAGERIAL EFFECTIVENESS 7

Definition - The person, process, product approaches - Bridging the Gap - Measuring Managerial Effectiveness - Current Industrial and Government practices in the Management of Managerial Effectiveness- the Effective Manager as an Optimizer.

UNIT IV: ENVIRONMENTAL ISSUES IN MANAGERIAL EFFECTIVENESS 8

Organisational Processes - Organisational Climate - Leader - Group Influences - Job Challenge - Competition - Managerial Styles.

UNIT V: DEVELOPING THE WINNING EDGE 10

Organisational and Managerial Efforts - Self Development - Negotiation Skills - Development of the Competitive Spirit - Knowledge Management - Fostering Creativity and innovation.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Expertised in Functional and level differences in Managerial Job behavior.
- Identified the managerial talent in designing the managerial job.
- Become the effective manager as an optimizer.
- Gain knowledge about appropriate style of managerial behaviour.
- Developed the negotiation skills in management.

TEXT BOOKS

1. Milkovich and Newman, Compensation, McGraw-Hill International, 2013.
2. Dubrin, Leadership, Research Findings, Practices & Skills, Biztantra, 2015

REFERENCES

1. Richard L.Daft, Leadership, Cengage, 1 st Indian Reprint 2008. (Tata McGraw-Hill)
2. Blanchard and Thacker, Effective Training Systems, Strategies and Practices Pearson 2012.

E-RESOURCES

1.https://link.springer.com/chapter/10.1007/978-1-349-03586-1_7(Organisationalprocesses)
2.https://www.ckju.net/en/dossier/organizational-climate-what-it-and-how-shapeit(Organisational climate)

21BATH05 ORGANISATIONAL THEORY DESIGN AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn how an organization can be designed and developed to deal with thechallenges from environment, technology, and its own processes.
- Know the importance of Organizational Design.
- Understand the importance of organizational culture in practicing managers.
- Analyze the difference between evolutionary and revolutionary change.
- Sustain the Organizational Learning.

UNIT I: ORGANISATION & ITS ENVIRONMENT **8**

Meaning of Organisation - Need for existence - Organisational Effectiveness - Creation of Value -Measuring Organisational Effectiveness - External Resources Approach, Internal Systems Approach and Technical approach - HR implications.

UNIT II: ORGANIZATIONAL DESIGN **15**

Organizational Design - Determinants - Components - Types - Basic Challenges of design - Differentiation, Integration, Centralization, Decentralization, Standardization, Mutual adjustment- Mechanistic and Organic Structures- Technological and Environmental Impacts on Design- Importance of Design - Success and Failures in design - Implications for Managers.

UNIT III: ORGANISATIONAL CULTURE **6**

Understanding Culture - Strong and Weak Cultures - Types of Cultures - Importance of Culture - Creating and Sustaining Culture - Culture and Strategy - Implications for practicing Managers.

UNIT IV: ORGANISATIONAL CHANGE **6**

Meaning - Forces for Change - Resistance to Change - Types and forms of change - Evolutionary and Revolutionary change - Change process -Organisation Development - HR functions and Strategic Change Management - Implications for practicing Managers.

UNIT V: ORGANISATION EVOLUTION AND SUSTENANCE **10**

Organizational life cycle - Models of transformation - Models of Organizational Decision making -Organizational Learning - Innovation, Intrapreneurship and Creativity-HR implications.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Analyze organizations more accurately and deeply by applyingorganization theory.
- Overcome technological and environmental impacts on design.
- Know Creating and Sustaining Culture.
- Manage HR functions and strategic change management.
- Become an intrapreneur to overcome HR implications .

TEXT BOOKS

1. Robbins Organisation Theory; Structure Design & Applications, Prentice Hall of India, 2009
2. Gareth R.Jones, Organisational Theory, Design & Change, Pearson Education, 6th Edition 2011

REFERENCES

1. Thomson G. Cummings and Christopher G. Worley, Organisational development and Change, cengage, 9th edition 2011
2. Adrian Thorn Hill, Phil Lewis, Mike Mill more and Mark Saunders, Managing Change - AHuman Resource Strategy Approach, Wiley, 2010

E-RESOURCES

1. https://www.marketing91.com/organizational-life-cycle/(Organisational life cycle)
2. .https://www.scribd.com/doc/106831979/Organisaional-Theory-Design-Development-Notes-1 (Organisational theory design and development)

21BATH06 STRATEGIC HUMAN RESOURCE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the transformation in the role of HR functions from being a support function to strategic function.
- Know the process of e- selection and recruitment.
- Educate cross cultural education and training programs.
- Gain knowledge in various stages involved in career and competency development.
- Manage role of HR in coaching.

UNIT I: HUMAN RESOURCE DEVELOPMENT 10

Meaning - Strategic framework for HRM and HRD - Vision, Mission and Values - Importance - Challenges to Organisations - HRD Functions - Roles of HRD Professionals - HRD Needs Assessment - HRD practices - Measures of HRD performance - Links to HR, Strategy and Business Goals - HRD Program Implementation and Evaluation - Recent trends - Strategic Capability , Bench Marking and HRD Audit.

UNIT II: E-HRM 6

e- Employee profile- e- selection and recruitment - Virtual learning and Orientation - e - training and development - e- Performance management and Compensation design - Development and Implementation of HRIS - Designing HR portals - Issues in employee privacy - Employee surveys online.

UNIT III: CROSS CULTURAL HRM 7

Domestic Vs International HRM - Cultural Dynamics - Culture Assessment - Cross Cultural Education and Training Programs - Leadership and Strategic HR Issues in International Assignments - Current challenges in Outsourcing, Cross border Mergers and Acquisitions - Repatriation etc - Building Multicultural Organisation - International Compensation.

UNIT IV: CAREER & COMPETENCY DEVELOPMENT 10

Career Concepts - Roles - Career stages - Career planning and Process - Career development Models- Career Motivation and Enrichment -Managing Career plateaus- Designing Effective Career Development Systems - Competencies and Career Management - Competency Mapping Models - Equity and Competency based Compensation.

UNIT V: EMPLOYEE COACHING & COUNSELING HIGH TECH E-BANKING **12**

Need for Coaching - Role of HR in coaching - Coaching and Performance - Skills for Effective Coaching - Coaching Effectiveness- Need for Counseling - Role of HR in Counseling - Components of Counseling Programs - Counseling Effectiveness - Employee Health and Welfare Programs - Work Stress - Sources - Consequences - Stress Management Techniques.- Eastern and Western Practices - Self Management and Emotional Intelligence.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Have a better understanding of the tools and techniques used by organizations to meet current challenges.
- Overcome issues in employee privacy.
- Know the difference between domestic vs international HRM.
- Design effective career development systems.
- Understand the techniques involve in stress management.

TEXT BOOKS

1. Randy L. Desimone, Jon M. Werner - David M. Mathis, Human Resource Development, Cengage Learning, Edition 6, 2012
2. Robert L. Mathis and John H. Jackson, Human Resource Management, Cengage, 2007.

REFERENCES

1. Monir Tayeb. International Human Resource Management. Oxford. 2007
2. Jeffrey A Mello, Strategic Human Resource Management, Cengage, Southwestern2007

E-RESOURCES

1. https://www.citehr.com/586559-mba-notes-strategic-human-resource-management.html(MBA notes for SHRM)
2. www.gurukpo.com/strategic-human-resource-management(strategic-human-resource-management)

21BATS01 ADVANCED DATABASE MANAGEMENT SYSTEM L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Enhance Competiveness in Social Marketing by ethical values and social media in Marketing.
- Understand the various advanced databases used in the organization
- Be aware of recent trends in database management.
- Learn the object oriented data base
- Understand the emerging trends in open source data base systems

UNIT I: INTRODUCTION **9**

DBMS Models - Multimedia Databases, Parallel Databases, embedded, web, spatial, temporal databases, Virtualization, Active Databases - Embedded databases - Web databases.

UNIT II: DATABASE IMPLEMENTATION **9**

Query Processing basics and optimization - Heuristic Optimization - Transactions Models - Concurrency Control - Recovery - Security and Authorization - Storage - Indexing and Hashing - ISAM - B-Trees - Kd Trees - X Trees - Dynamic Hashing.

UNIT III: DISTRIBUTED DATABASES **9**

Distributed Databases - Queries - Optimization Access Strategies - Distributed Transactions Management - Concurrency Control – Reliability.

UNIT IV: OBJECT ORIENTED DATABASES **9**

Object Oriented Concepts - Data Object Models -Object Oriented Databases - Issues in OODBMS -Object Oriented Relational Databases - Object Definition Languages - Object Query Languages.

UNIT V: EMERGING TRENDS **9**

Data Mining - Data warehousing - Star, Snowflake, Fact Constellation; open source database systems, Scripting Language, JDBC, ODBC.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Create awareness of database models.
- Gain knowledge of database technologies.
- Detailed knowledge about distributed database.
- Familiarize the data warehousing.
- Understand the detailed object oriented.

TEXT BOOKS

1. Jeffrey A Hoffer et al, Modern Database Management, 12th Edition, Pearson Education, 2016.
2. Abraham Silberchatz, Henry F. Korth and S.Sudarsan, Database System Concepts, 6th Edition, McGraw-Hill, 2015.

REFERENCES

1. Rajesh Narang, Object Oriented Interfaces and Databases, 1st edition ,Prentice Hall of India, 2004.
2. Charkrabarti, Advanced Database Management Systems, Wiley India Pvt Ltd, 2011

E-RESOURCES

1. https://www.tutorialspoint.com/dbms(DataBase Management System)
2. https://lecturenotes.in/subject/38/database-management-system-dbms(DBMSNotes)

21BATS02 DATAMINING FOR BUSINESS INTELLIGENCE L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Know how to derive meaning form huge volume of data and information.
- Understand how knowledge discovering process is used in business decision making.
- Familiarize the concepts of regression and correlation in data mining methods.
- Know more detailed about business intelligence.
- Access the detail knowledge in genetics , medical, pharmaceutical.

UNIT I: INTRODUCTION **9**

Data mining, Text mining, Web mining, Spatial mining, Process mining, BI process- Private and Public intelligence, Strategic assessment of implementing BI.

UNIT II: DATA WAREHOUSING **9**

Data ware house - characteristics and view - OLTP and OLAP - Design and development of data warehouse, Meta data models, Extract/ Transform / Load (ETL) design.

UNIT III: DATA MINING TOOLS, METHODS AND TECHNIQUES **9**

Regression and correlation; Classification- Decision trees; clustering -Neural networks; Market basket analysis- Association rules-Genetic algorithms and link analysis, Support Vector Machine, Ant Colony Optimization.

UNIT IV: MODERN INFORMATION TECHNOLOGY AND ITS BUSINESS OPPORTUNITIES **9**

Business intelligence software, BI on web, Ethical and legal limits, Industrial espionage, modern techniques of crypto analysis, managing and organizing for an effective BI Team.

UNIT V: BI AND DATA MINING APPLICATIONS **9**

Applications in various sectors - Retailing, CRM, Banking, Stock Pricing, Production, Crime, Genetics, Medical, Pharmaceutical.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Know the Big Data Management.
- Appreciate the techniques of knowledge discovery for business applications.
- Gain knowledge in market basket analysis.
- Understand the modern techniques of crypto analysis.
- Students molded in the area of data mining applications

TEXT BOOKS

1. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 2005.
2. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 3nd Edition, 2011

REFERENCES

1. G. K. Gupta, Ïntroduction to Data mining with Case Studies, Prentice hall of India, 2014.
2. Giudici, Applied Data mining - Statistical Methods for Business and Industry, John Wiley. 2009

E-RESOURCES

1. https://www.egafutura.com/wiki-en/data-mining-applications(Data mining applications for business intelligence)
2. https://www.dataintegration.info/business-intelligence(Businessintelligence)

21BATS03 **ENTERPRISE RESOURCE PLANNING** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the business process of an enterprise.
- Grasp the activities of erp project management cycle.
- Understand the emerging trends in erp developments.
- Know the knowledge of maintenance of ERP.
- Enrich the knowledge in could computing.

UNIT I: INTRODUCTION **8**

Overview of enterprise systems - Evolution - Risks and benefits - Fundamental technology - Issues to be consider in planning design and implementation of cross functional integrated ERP systems.

UNIT II: ERP SOLUTIONS AND FUNCTIONAL MODULES **10**

Overview of ERP software solutions- Small, medium and large enterprise vendor solutions,BPR, and best business practices - Business process Management, Functional modules.

UNIT III: ERP IMPLEMENTATION **10**

Planning Evaluation and selection of ERP systems - Implementation life cycle - ERP implementation, Methodology and Frame work- Training - Data Migration. People Organization in implementation-Consultants, Vendors and Employees.

UNIT IV: POST IMPLEMENTATION **8**

Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation.

UNIT V: EMERGING TRENDS ON ERP **9**

Extended ERP systems and ERP add-ons -CRM, SCM, Business analytics- Future trends in ERP systems-web enabled, Wireless technologies, cloud computing.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gain knowledge of ERP implementation cycle.
- Create awareness of core and extended modules of ERP.
- Enumerate the knowledge in data migration.
- Understand the organizational and industrial impact of ERP.
- Ensured the knowledge known about web enabled system and wireless technologies.

TEXT BOOKS

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2008.
2. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, second editionPrentice Hall of India, 2009.

REFERENCES

1. Alexis Leon, Enterprise Resource Planning, third edition, Tata McGraw-Hill, 2014.
2. Summer, ERP, Pearson Education, 2016

E-RESOURCES

1. https://en.wikipedia.org/wiki/Enterprise_resource_planning (Enterprise resource planning)
2. https://www.investopedia.com›Business›BusinessEssentials (Business Essentials)

21BATS04 SOFTWARE PROJECT MANAGEMENT AND QUALITY L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the various project management phases - Initiation, Planning, Trackingand Closure.
- Study various project estimation methodologies, process models and risk management.
- Understand quality assurance in software development.
- Detailed understanding about Steps for Process Improvement.
- Study the concepts of Sprint Planning.

UNIT I: PROJECT MANAGEMENT OVERVIEW 8

What is Project and Project Management, Various phase of Project Management, Project Stakeholders, Project Management Organisation (PMO);Roles and Responsibilities of Project Manager. Brief introduction to various process models - Waterfall, RAD, V, Spiral, Incremental, Prototyping, Agile- SCRUM, Extreme Programming (XP) and Kanban **Project Initiation -** Project Charter; Statement of Work (SoW)

UNIT II: PROJECT PLANNING 10

Project Planning Activities- Project Scope, Work Breakdown Structures (WBS), Software estimation methodologies - COCOMO Model and Function Point

Project Scheduling Techniques **-** Program Evaluation and Review Technique (PERT), Gantt Chart and Critical Path Method (CPM)

UNIT III: PROJECT TRACKING 10

Monitoring and Control, Project Status Reporting; Project Metrics; Earned Value Analysis (EVA); Project Communication Plan & Techniques; Steps for Process Improvement.Risk Management: Concepts of Risks and Risk Management; Risk Management Activities; Effective Risk Management; Risk Categories; Aids for Risk Identification; Potential Risk Treatments; Risk Components and Drivers; Risk Prioritization.

UNIT IV: PROJECT CLOSURE 8

Project Closure Analysis, Lesson Learnt Software Quality Assurance-Software Quality Assurance Activities; Software Qualities; Software Quality Standards - ISO Standards for Software Organization, Capability Maturity Model (CMM), Comparison between ISO 9001 & SEI CMM, Other Standards.

UNIT V: AGILE PROJECT MANAGEMENT WITH SCRUM **9**

Agile Manifesto and Agile Principles Agile Scrum - Purpose, Values, Scrum Framework, Scrum Roles - Product Owner, Scrum Master & Team, Scrum Events - Sprint Planning, Daily Scrum/Stand-up Meeting, Sprint Review, Sprint Retrospective, Scrum Artefacts - Product Backlog, Sprint Backlog, Increment and Definition of Done (DoD), Agile estimation - Story Point.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Manage different phases of Software Project Management.
- Identify Risk and create risk mitigation plan.
- Apply software quality assurance for better quality software delivery.
- Gain knowledge of effective risk management.
- More detailed understanding of ISO standards and scrum roles.

TEXT BOOKS

1. Bob Hughes and Mike Cotterell, Software Project Management, Tata McGraw Hill, 5 Edition
2. Jalote, "Software Project Management in Practice", Pearson Education

REFERENCES

1. Ramesh, Gopalaswamy, "Managing Global Projects", Tata McGraw Hill
2. Royce, "Software Project Management", Pearson Education, 1999.

E-RESOURCES

1. https://www.tutorialspoint.com/software_engineering/software_project_management(software_project_management)
2. https://www.techopedia.com/definition/13132/project-management-software(Project management software)

21BATS05 **E- BUSINESS MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the practices and technology to start an online business.
- Study the concepts of internet protocols and web server hardware and software.
- Enumerate the knowledge of web advertising and e mail marketing.
- Study the e-Wallets and Micro payment systems.
- Explain the concepts in consumer protection, cyber laws.

UNIT I: INTRODUCTION TO e-BUSINESS **8**

Business, e-business vs e-commerce, Economic forces – advantages – myths – e - business models, design, develop and manage - business, Web 2.0 and Social Networking, Mobile Commerce, S- commerce.

UNIT II: TECHNOLOGY INFRASTRUCTURE **10**

Internet and World Wide Web, internet protocols - FTP, intranet and extranet, Cloud Service Models -SAAS, PAAS, IAAS, Cloud Deployment Models - Public Cloud, Private Cloud, Hybrid Cloud, Auto-Scaling in the Cloud, Internet information publishing technology- basics of web server hardware and software.

UNIT III: BUSINESS APPLICATIONS **10**

Consumer oriented e-business-e-tailing and models-Marketing on web-advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, e-governance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals-social media marketing.

UNIT IV: e-BUSINESS PAYMENTS AND SECURITY **9**

E-payments -Characteristics of payment of systems, protocols, e-cash, e-cheque, e-Wallets and Micro payment systems- internet security-cryptography -security protocols-network security.

UNIT V: LEGAL AND PRIVACY ISSUES **8**

Legal, Ethics and privacy issues - Protection needs and methodology - consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Know how to build and manage an e-business.
- Gain knowledge about Cloud Deployment Models.
- Understand the knowledge about delivery management system.
- Apply the practical knowledge In security protocols and network security.
- Reveal the knowledge of taxation and encryption and policies.

TEXT BOOKS

1. Harvey M. Deitel, Paul J.Deitel, Kate Steinbuhler, e-business and e-commerce for managers,
Pearson, 2011.
2. Parag Kulkarni, Sunita Jahirabad kao, Pradeep Chande, e business, Oxford University Press, 2012.

REFERENCES

1. Bharat Bhasker, Electronic Commerce, Framework technologies and Applications, 3rd Edition. Tata McGraw Hill Publications, 2009
2. Kalakotaet al, Frontiers ofElectronicCommerce,AddisonWesley,2004

E-RESOURCES

1. https://lecturenotes.in/subject/577/e-business-ebs(EBS Notes)
2. http://ncdrc.nic.in/bare_acts/ConsumerProtectionAct-1986.(Consumer protection Act 1986)

21BATO01 **LOGISTICS MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the need and importance of logistics in product flow.
- Understand the concepts of Distribution channel structure.
- Know the transportation systems and material and cost packaging.
- Study the performance measurement and accounting methods.
- Understand the knowledge of logistics information system.

UNIT I: INTRODUCTION **9**

Definition and Scope of Logistics - Functions & Objectives - Customer Value Chain - Service Phases and attributes - Value added logistics services - Role of logistics in Competitive strategy -Customer Service

UNIT II: DISTRIBUTION CHANNELS AND OUTSOURCING LOGISTICS **9**

Distribution channel structure - channel members, channel strategy, role of logistics and support in distribution channels. Logistics requirements of channel members.

Logistics outsourcing - catalysts, benefits, value proposition. Third and fourth party logistics. Selection of service provider.

UNIT III: TRANSPORTATION AND PACKAGING **9**

Transportation System - Evolution, Infrastructure and Networks. Freight Management - Vehicle Routing - Containerization. Modal Characteristics, Inter-modal Operators and Transport Economies. Packaging- Design considerations, Material and Cost. Packaging as Unitisation. Consumer and Industrial Packaging.

UNIT IV: PERFORMANCE MEASUREMENT AND COSTS **9**

Performance Measurement - Need, System, Levels and Dimensions. Internal and External Performance Measurement. Logistics Audit. Total Logistics Cost - Concept, Accounting Methods. Cost - Identification, Time Frame and Formatting.

UNIT V: CURRENT TRENDS **9**

Logistics Information Systems - Need, Characteristics and Design. E-Logistics - Structure and Operation. Logistics Resource Management eLRM. Automatic Identification Technologies. Reverse Logistics - Scope, design and as a competitive tool. Global Logistics - Operational and Strategic Issues, ocean and air transportation. Strategic logistics planning. Green Logistics

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Enable an efficient method of moving products with optimization of time and cost.
- Gain the knowledge of Logistics and support in distribution channels.
- Familiarize the concepts of Evaluation infrastructure and networks.
- Understand the Measurement. Logistics Audit.
- Lead the concept of Logistics Resource Management eLRM.

TEXT BOOKS

1. Bowersox Donald J, Logistics Management - The Integrated Supply Chain Process, Tata McGraw Hill,3rd edition 2016
2. Ailawadi C Sathish & Rakesh Singh, Logistics Management, PHI, 2011.

REFERENCES

1. Ronald H. Ballou, Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007.
2. Bloomberg David J et al., Logistics, Prentice Hall India, 2005

E-RESOURCES

1. https://studymafia.org/logistics-management-ppt-with-pdf-free-to-download(Logistics management)
2. https://www.redwoodlogistics.com/what-is-freight-management/(FreightManagement)

21BATO02 **MATERIALS MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand how material management should be considered for profitability.
- Know the knowledge about production activity control.
- Study the inventory management.
- Explain the purchase management in detail.
- Make awareness about Warehousing functions.

UNIT I: INTRODUCTION **9**

Operating environment-aggregate planning-role, need, strategies, costs techniques, approaches-master scheduling-manufacturing planning and control system-manufacturing resource planning-enterprise resource planning-making the production plan.

UNIT II: MATERIALS PLANNING **9**

Materials requirements planning-bill of materials-resource requirement planning-manufacturing resource planning-capacity management-scheduling orders-production activity control-codification.

UNIT III: INVENTORY MANAGEMENT **9**

Policy Decisions-objectives-control -Retail Discounting Model, Newsvendor Model; EOQ and EBQ models for uniform and variable demand With and without shortages -Quantity discount models. Probabilistic inventory models.

UNIT IV: PURCHASING MANAGEMENT **9**

Establishing specifications-selecting suppliers-price determination-forward buying-mixed buying strategy-price forecasting-buying seasonal commodities-purchasing under uncertainty-demand management-price forecasting-purchasing under uncertainty-purchasing of capital equipment-international purchasing.

UNIT V: WAREHOUSE MANAGEMENT **9**

Warehousing functions - types - Stores management-stores systems and procedures-incoming materials control-stores accounting and stock verification-Obsolete, surplus and scrap-value analysis-material handling-transportation and traffic management -operational efficiency-productivity-cost effectiveness-performance measurement.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gain knowledge on effective utilization of materials in manufacturing and service organization.
- Familiarize the concepts of capacity management.
- Create more awareness and understanding of Probabilistic inventory models.
- Understand the concepts of price determination.
- Study the details of stores systems and procedures.

TEXT BOOKS

1. S. N. Chary, Production and Operations Management, Tata McGraw Hill , 2012
2. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, Pearson education, Fifth Edition

REFERENCES

1. P. Gopalakrishnan, Purchasing and Materials Management, Tata McGraw Hill, 2012
2. J.R.Tony Arnold, Stephen N. Chapman, Lloyd M. Clive, Materials Management, Pearson, 2012.

E-RESOURCES

1. https://studymafia.org/logistics-management-ppt-with-pdf-free-to-download/(Logistics Management)
2. https://www.ispatguru.com/stores-management/(stores-management)

21BATO03	PRODUCT DESIGN	L T P C 3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the application of structured methods to develop a product.
- Study the product life cycle.
- Know the product testing and its concepts.
- Familiar the concepts of Product development.
- Understand the Patent Searches and Application.

UNIT I: INTRODUCTION **9**

Defining Product, Types of products. Product development - characteristics, duration and cost, challenges. Development Process: Generic Process- Adapting to product types. Evaluation – decay curve - cost expenditure curve.

UNIT II: PRODUCT PLANNING **9**

Product Planning Process - Steps. Opportunity identification - breakdown structure- product development charter. Product Life Cycle. Technology Life Cycle - Understanding Customer Needs -Disruptive Technologies- Product Specification - Concept Generation - Activity- Steps- Techniques.

UNIT III: PRODUCT CONCEPT **9**

Concept Selection - Importance, Methodology, concept Screening, Concept Scoring. Concept Testing. Product Architecture- Definition, Modularity, implication, Establishment, Delayed Differentiation, Platform Planning.

UNIT IV: INDUSTRIAL DESIGN AND DESIGN TOOLS **9**

Industrial Design, Design for Manufacturing-Value Engineering-Ergonomics-Prototyping-Robust Design-Design for X-failure rate curve-product use testing-Collaborative Product development-Product development economics-scoring model- financial analysis.

UNIT V: PATENTS **9**

Defining Intellectual Property and Patents, Patent Searches and Application, Patent Ownership and Transfer, Patent Infringement, New Developments and International Patent Law.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gain knowledge on how a product is designed based on the needs of a customer.
- Familiarize the Product Specification and techniques.
- Lead the concept of Product Architecture.
- Understand the techniques of financial analysis.
- Know the patent infringement in detail

TEXT BOOKS

1. Harvey Maylor, Project Management, Fourth Edition, Pearson Education, 2010
2. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition, 6e,2014.

REFERENCES

1. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education,5th Edition 2016
2. Gido and Clements, Successful Project Management, sixth Edition, Cengage, 2015.

E-RESOURCES

1. www.edo.ca/downloads/project-management.pdf(Inroduction to project management)
2. ebooks.lpude.in/management/mba/term_3/DMGT521_PROJECT_MANAGEMENT.pdf(Project management notes)

21BATO04 **PROJECT MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Learn the concepts of managing projects.
- Know the detailed project management process.
- Understand the concepts of resource loading and leveling.
- Study the plan monitor control cycle and project control.
- Understand the formal organization structure.

UNIT I: INTRODUCTION TO PROJECT MANAGEMENT **9**

Project Management - Definition -Goal - Lifecycles. Project Selection Methods. Project Portfolio Process - Project Formulation. Project Manager - Roles- Responsibilities and Selection - Project Teams.

UNIT II: PLANNING AND BUDGETING **9**

The Planning Process - Work Break down Structure - Role of Multidisciplinary teams. Budget the Project - Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

UNIT III: SCHEDULING & RESOURCE ALLOCATION **9**

PERT & CPM Networks - Crashing - Project Uncertainty and Risk Management - Simulation - Gantt Charts - Expediting a project - Resource loading and leveling. Allocating scarce resources -Goldratt‟s Critical Chain.

UNIT IV: CONTROL AND COMPLETION **9**

The Plan-Monitor-Control cycle - Data Collecting and reporting - Project Control - Designing the control system. Project Evaluation, Auditing and Termination.

UNIT V: PROJECT ORGANISATION & CONFLICT MANAGEMENT **9**

Formal Organization Structure - Organization Design - Types of project organizations. Conflict - Origin & Consequences. Managing conflict - Team methods for resolving conflict.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Apply project management principles in business situations to optimize resource utilization and time optimization.
- Gain the knowledge of Project Selection Methods.
- Understand the Project Uncertainty and Risk Management.
- Familiarize the Auditing and Termination.
- Gain knowledge about Team methods for resolving conflict.

TEXT BOOKS

1. Harvey Maylor, Project Management, Fourth Edition, Pearson Education, 2010
2. Clifford Gray and Erik Larson, Project Management, Tata McGraw Hill Edition,6e,2014

REFERENCES

1. John M. Nicholas, Project Management for Business and Technology - Principles and Practice, Second Edition, Pearson Education,5th Edition 2016
2. Gido and Clements, Successful Project Management, sixth Edition, Cengage, 2015.

E-RESOURCES

1. www.edo.ca/downloads/project-management.pdf(project-management)
2. ebooks.lpude.in/management/mba/term_3/DMGT521_PROJECT_MANAGEMENT.pdf (Proje ct management notes)

21BATO05 SERVICES OPERATIONS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand how service performance can be improved by studying services operations management.
- Gain the knowledge about Retail design strategies.
- Study the concepts of design elements.
- Understand the Service Quality Gap Model.
- Reveal the knowledge of Inventory Management in Services.

UNIT I: INTRODUCTION **9**

Services - Importance, role in economy, service sector - growth; Nature of services -Service classification , Service Package, distinctive characteristics , open-systems view; Service Strategy -Strategic service vision, competitive environment, generic strategies, winning customers; Role of information technology; stages in service firm competitiveness; Internet strategies - Environmental strategies.

UNIT II: SERVICE DESIGN **9**

New Service Development - Design elements - Service Blue-printing - process structure - generic approaches -Value to customer; Retail design strategies - store size - Network configuration; Managing Service Experience -experience economy, key dimensions; Vehicle Routing and Scheduling.

UNIT III: SERVICE QUALITY **9**

Service Quality- Dimensions, Service Quality Gap Model; Measuring Service Quality - SERVQUAL -Walk-through Audit; Quality service by design - Service Recovery - Service Guarantees; Service Encounter - triad, creating service orientation, service profit chain; Front-office Back-office Interface -service decoupling.

UNIT IV: SERVICE FACILITY **9**

Services capes - behaviour - environmental dimensions - framework; Facility design - nature, objectives, process analysis - process flow diagram, process steps, simulation; Service facility layout; Service Facility Location - considerations, facility location techniques - metropolitan metric, Euclidean, centre of gravity, retail outlet location , location set covering problem.

UNIT V: MANAGING CAPACITY AND DEMAND **9**

Managing Demand - strategies; Managing capacity - basic strategies, supply management tactics, operations planning and control; Yield management; Inventory Management in Services- Retail Discounting Model, Newsvendor Model; Managing Waiting Lines -Queuing systems, psychology of waiting; Managing for growth- expansion strategies, franchising , globalization.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Design and operate a service business using the concepts, tools and techniques of service operations management.
- Gain the knowledge of Network configuration.
- Study the concepts of Quality service by design.
- Know the concepts of Service Facility Location.
- Molded the concepts of Inventory Management in Services.

TEXT BOOKS

1. Robert Johnston, Graham Clark, Service Operations Management, Pearson Education, 2nd Edition, 2005.
2. Richard Metters, Kathryn King-Metters, Madeleine Pullman, Steve Walton Successful Service Operations Management, South-Western, Cengage Learning, 2nd Edition ,2012

REFERENCES

1. James A. Fitzsimmons, Service Management - Operations, Strategy, Information Technology, Tata McGraw-Hill - 7th Edition 2013.
2. Bill Hollins and Sadie Shinkins, Managing Service Operations, Sage, 2006

E-RESOURCES

1. https://examupdates.in/production-and-operations-management-notes(production-and-operations-management-notes)
2. www.vssut.ac.in/lecture_notes/lecture1429900757.pdf(Lecture notes on production and operationmanagement

21BATO06 **SUPPLY CHAIN MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the importance of and major decisions in supply chain management.
- Know the Concept of Supplier Selection and Contract Negotiation.
- Understand the Impact of uncertainty on Network Design.
- Explain the concepts of multiple location inventory management.
- Understand the concepts of Supply Chain Integration.

UNIT I: INTRODUCTION **9**

Supply Chain - Fundamentals -Evolution- Role in Economy - Importance - Decision Phases - Supplier-Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy -Supply Chain Performance Measures.

UNIT II: STRATEGIC SOURCING **9**

Outsourcing - Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. Creating a world class supply base-Supplier Development - World Wide Sourcing.

UNIT III: SUPPLY CHAIN NETWORK **9**

Distribution Network Design - Role - Factors Influencing Options, Value Addition - Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. Supply Chain Network optimization models. Impact of uncertainty on Network Design - Network Design decisions using Decision trees.

UNIT IV: PLANNING DEMAND, INVENTORY AND SUPPLY **9**

Managing supply chain cycle inventory. Uncertainty in the supply chain **-** Analyzing impact of supply chain redesign on the inventory - Risk Pooling - Managing inventory for short life - cycle products -multiple item -multiple location inventory management. Pricing and Revenue Management.

UNIT V: CURRENT TRENDS **9**

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect -Effective forecasting - Coordinating the supply chain. . SC Restructuring - SC Mapping - SC process restructuring, Postpone the point of differentiation - IT in Supply Chain - Agile Supply Chains -Reverse Supply chain. Agro Supply Chains

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Build and manage a competitive supply chain using strategies, models,techniques and information technology.
- Understand the concept of Supply chain strategy.
- Gain the knowledge of Network Design decisions using Decision trees
- Familiarize the concept of Managing inventory for short life.
- Understand the concept of Agile Supply Chains.

TEXT BOOKS

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, andOperation, Pearson, 2010.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill, 2005.

REFERENCES

1. Ballou Ronald H,Business Logistics and Supply Chain Management, Pearson Education, 5th Edition, 2007
2. Shapiro Jeremy F, Modeling the Supply Chain, Cengage, Second Reprint ,2002.(Thomson**)**

E-RESOURCES

1. https://www.tutorialspoint.com/supply_chain_management(SCM tutorial)
2. https://www.mixmove.io/post/supply-chain-integration(supply-chain-integration)

21BATH11 FUNDAMENTALS OF HEALTHCARE ADMINISTRATION L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Acquire professional management practice in healthcare.
- Understand the management process and integrated approach in management.
- Manage hospitals by understanding the complexity, levels and role of hospital administrator.
- Know the roles and responsibilities of middle level managers in hospital.
- Attain knowledge about health tourism.

UNIT I: MANAGEMENT CONCEPTS AND THEORIES 9

Management and Organizations - Management Role- Levels of Managers and Management Skills - Classical School- Behaviour School-Management Science School

UNIT II: MANAGEMENT FUNCTIONS AND PROCESS 9

Planning- Organizing -Staffing - Directing-Controlling

UNIT III: SERVICES, HEALTH AND HOSPITALS 9

Services- Classification of Service Organization- Characteristics- Challenges History of Medicine-Healthcare Revolution-Health- Dimensions of Health- Indicators of Health Types of Healthcare Organizations- Composition of Health Sector- Types of Care-Pyramidal Structure of Health Services- Hospitals- Types of Hospitals and Role of Hospital in Healthcare - Complexity of Hospital Organization.

UNIT IV: HOSPITAL MANAGEMENT: LEVELS AND ROLES 9

Governing Board, Executive Board and Advisory Board - CEO, Medical Administration, Nursing Administration and Hospital Administration- Middle Level Managers in Hospital and their Responsibilities

UNIT V: CURRENT ISSUES IN HEALTHCARE 9

Accreditation- Tele health-Health Tourism- Health Insurance and Managed Care -Disaster Management - Hospital Wastes Management

TOTAL :45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understand professional management practices in Hospital.
- Expertise in management functions and process.
- Understand services offered by hospital and healthcare industry.
- Understand the levels and roles of hospital management.
- Develop knowledge about current issues related to healthcare industry.

TEXT BOOKS

1. Peter M Ginter, W. Jack Duncan, Linda E Swayne,'Strategic Management of health care organization'8th edition,Wiley,2017
2. Gupta,'Hospital Administration and Management: A comprehensive guide', Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi,2016

REFERENCES

1. Elaine La Monica, 'Management in Health Care',Macmillan Press Ltd, London,2010
2. J.E. Park and K. Park, 'Textbook of Preventive and Social Medicine' (M/S Banarsidas Bhanot Publishers, Jabalpur,2011

E-RESOURCES

1. https://telehealth.hhs.gov/patients/understanding-telehealth/(Telehealth)
2. https://www.technofunc.com/index.php/domain-knowledge/healthcare industry/item/hospitals - (Types of Hospitals and Role of Hospital in Healthcare)

21BATH12 HEALTHCARE PLANNING, DESIGN & MAINTENANCE L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide the introduction to origin of Hospitals and its development
- Know the supportive and ancillary service departments.
- Provide the concept of project management.
- Provide the information on project formulation.
- Provide the understanding of systems, WBS, project evaluation and effective project management.

UNIT I: INTRODUCTION 9

Concept of Hospital architecture - Planning and Design of a Hospital (Building & Physical Layout) - Space Required for Separate Functions - Different types of Hospitals - Problems and Constraints in different type of Hospitals - History of Hospital Development

UNIT II: DEPARTMENTATION AND ORGANIZATION STRUCTURE 9

Organization - Structure -Departmentation and organization structure of different types of hospitals. Vertical & Horizontal - Clinical & Non Clinical - Supportive& Ancillary Service Departments.

UNIT III: CONCEPT OF A PROJECT 9

Concept of hospital project management - Concept of a project - categories of projects - projects life cycle phases - project management concepts - tools and techniques for project management. Theproject manager - roles and responsibilities of project manager.

UNIT IV: PROJECT FORMULATION 9

Project formulation for hospital construction- stages - bottlenecks - feasibility report - financing arrangements - finalization of project - implementation schedule-project execution plan - project procedure manual project control system - planning scheduling and monitoring - monitoring contracts and projects diary - Project implementation stages project direction - communications in a project - coordination guidelines for effective implementation reporting in project management - project evaluation and its objectives, types and methods.

UNIT V: ORGANIZING SYSTEMS AND PROCEDURES **9**

Organizing systems and procedures for maintenance of hospitals- working of systems - design of systems - projects work systems design - work break down structure - Organizing human resources and contracting - team building

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Expertise in designing in hospital architecture.
- Understand the different departmentation of Hospitals based on the service.
- Understand the concept of project management - hospital pre commissioning stage – commissioning stage - post commissioning stage.
- Understand the framework of project formulation from concept to culmination.
- Understand the authority of Project Manager, tendering procedure and contract formalities.

TEXT BOOKS

1. Piggott, Carolyn Semple,' Business Planning for health care management' U.K Open University Press
2. Peter Berman, 'Health Sector Reform in Developing Countries' - Harvard University Press,1995.

REFERENCES

1. Blane,David,Brunner, Eric .'Health and Social organization: Towards a health policy for the 21st century' - Calrendon Press.
2. Kant Gupta, Shakti Kumar Gupta ,'Modern Trends in Planning and Designing of Hospitals' -Jaypee Brothers Publishers.

E-RESOURCES

1. http://cedglobal.org/wp-content/uploads/2016/Ziken%20EN/HCTGuide5.pdf(Organizing systems and procedures for maintenance of hospitals)
2. https://activecollab.com/blog/project-management/project-manager-roles-and-responsibilities (roles and responsibilities of project manager)

21BATH13 HOSPITAL FRONT OFFICE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Introduce Routine Admission / Discharge Procedures / Discharge Summary, Telephone etiquettes and manners.
- Acquire knowledge in Relevance and importance of Customer / Patient Service Excellence.
- Elucidate on Importance of Communication in Healthcare.
- Know the Medical terminology applicable to Front Effectively Handling Waiting time in the OPDs.
- Elaborate on basic Reception Duties.

UNIT I: INTRODUCTION 9

Introduction to hospital Industry. Routine Admission/Discharge Procedures/Discharge Summary, Telephone etiquettes and manners. Front desk grooming and other essentials - body language, speech modulation which includes articulation, variation control of pitch and tonal quality. Dressingsense and basic Grooming tips for the Front Office.

UNIT II: ENSURING PATIENT SATISFACTION 9

Outpatient services - inpatient services - Accident and Emergency Services. Relevance and importance of Customer / Patient Service Excellence in Healthcare. Effectively handling different Categories of Patients - Paid / Non-Paid, Emergency, VIPs etc. Challenges in Catering to Insurance and other Corporate patients Handling Irate Customers and patient attenders Ensuring patient satisfaction -Contribution of the Front Office.

UNIT III: COMMUNICATION 9

Importance of Communication in Healthcare. Communication is less talking and more Listening - Learn why? Communicating with traumatized patients and their attenders Effective Communication for Front Office involved in Billing and Accounts Communicating and empathizing with attenders of adeceased patient Interdepartmental Communication - Issues and challenges

UNIT IV: STRESS MANAGEMENT 9

Team Building / Team Dynamics. Attitude building. Anger, Conflict, Crisis & Stress Management. Multi-tasking. NABH & other quality standards applicable to the Front Office Importance of Documentation, Automation and IT in the Front Office. Medical terminology applicable to Front Effectively Handling Waiting time in the OPDs

UNIT V: DUTIES AND RESPONSIBILITIES **9**

Reception Duties- Collecting Patient Information-Information management in case sheets-Billing and Coding- Making Appointments- Minor Office Equipment Usage-Emergency handling.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understand in Telephone etiquettes and manners.
- Be aware of basic Outpatient services and inpatient services & becomes capable of devising plans to ensure patient satisfaction.
- Be aware of handling communication with traumatized patient and their attenders.
- Introduced fundamentals of front office management in hospital environment.
- Identified the reception duties and responsibilities in hospitals.

TEXT BOOKS

1. De A. Eggers, Anne M. Conway ,'Mosby's Front Office Skills for the Medical Assistant. Eggers' MosbyPublishers , 1999.
2. Dr S Porkodi ,'Patient Care services and Hospitals 'First edition ,Excel Books,2012

REFERENCES

1. R o s s. Willson,'From Front Office to Front Line: Essential Issues for Health Care' 2nd edition, Joint Commission Resources,2011
2. K.V.Ramani ,'Hospital Management-Text and Cases' First Edition, Pearson Education India,1999.

E-RESOURCES

1. https://www.columbiaindiahospitals.com/health-articles/accident-and-emergency-patient-care-services-hospital (Accident and Emergency Services)
2. https://teambuilding.com/ (Team Building)

21BATH14 HOSPITAL WASTE MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Gain knowledge about health care and hazard control.
- Understand various waste disposal procedures and management.
- Understand the hazardous materials used in hospital and its impact on health.
- Acquire facility safety measures in hospital waste management.
- Analyze quality improvement tools and strategies in patient safety.

UNIT I: HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS 9

Healthcare Hazard Control : Introduction, Hazard Control, Hazard Control Management, Hazard Control Responsibilities, Addressing Behaviors, Hazard Control Practice, Understanding Hazards, Hazard Analysis, Hazard Control and Correction, Personal Protective Equipment, Hazard Control Committees, Hazard Control Evaluation, Hazards, System Safety, Ergonomics. Understanding Accidents: Accident Causation Theories, Human Factors, Accident Deviation Models, Accident Reporting, Accident Investigations, Accident Analysis, Organizational Functions That Support Accident Prevention, Workers' Compensation, Orientation, Education, and Training.

UNIT II: BIOMEDICAL WASTE MANAGEMENT 9

Biomedical Waste Management: Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III: HAZARDOUS MATERIALS 9

Hazardous Materials : Hazardous Substance Safety, OSHA Hazard Communication Standard, DOT Hazardous Material Regulations, Healthcare Hazardous Materials, Medical Gas Systems, Hazardous Waste Operations and Emergency Response Standard, Respiratory Protection.

UNITIV: FACILITY SAFETY 9

Facility Safety : Introduction, Facility Guidelines Institute, Administrative Area Safety, Slip, Trip, and Fall Prevention, Safety Signs, Colors, and Marking Requirements, Scaffolding, Fall Protection,Tool Safety, Machine Guarding, Compressed Air Safety, Electrical Safety, Control of Hazardous Energy, Permit Confined Spaces, OSHA Hearing Conservation Standard, Heating,

Ventilating, and Air-Conditioning Systems, Assessing IAQ, Landscape and Grounds Maintenance, Fleet and Vehicle Safety.

UNIT V: INFECTION CONTROL, PREVENTION AND PATIENT SAFETY **9**

Healthcare Immunizations, Centers for Disease Control and Prevention, Disinfectants, Sterilants, and Antiseptics, OSHA Bloodborne Pathogens Standard, Tuberculosis, Healthcare Opportunistic Infections, Medical Waste. Patient Safety: An Organizational Function, Errors and Adverse Events, Safety Cultures, Patient-Centered Healthcare, Quality Improvement Tools and Strategies, Healthcare-Associated Infections, Medication Safety.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Analyse various hazards, accidents and its control.
- Design waste disposal procedures for different biowastes.
- Categorise different biowastes based on its properties.
- Design different safety facility in hospitals.
- Propose various regulations and safety norms.

TEXT BOOKS

1. Tweedy, James T., Healthcare hazard control and safety management-CRC Press_Taylor andFrancis (2014).
2. Anantpreet Singh, Sukhjit Kaur, Biomedical Waste Disposal, Jaypee Brothers Medical Publishers (P) Ltd (2012).

REFERENCES

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI — FourthEdition,2006
2. V.J. Landrum, "Medical Waste Management and disposal", Elsevier, 1991

E-RESOURCES

1. https://www.sciencedirect.com/topics/immunology-and-microbiology/opportunistic-infection (Healthcare Opportunistic Infections)
2. https://www.sciencedirect.com/science/article/abs/pii/000145758490023X(AccidentDeviation Models)

21BATH15 **HEALTH CARE LAWS & ETHICS** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide the Code of Medical Ethics.
- Implement ethical issues in stroke management and dementia.
- Know the regulation of pre-natal diagnostic technique.
- Provide the details about the Medical Jurisprudence.
- Provide the legal framework for hospitals.

UNIT I: CODE OF MEDICAL ETHICS **9**

Principle of medical ethics-confidentiality-informed consent-decisions on life-sustaining therapy-Communication, barriers to it and information sharing.Medical Ethics/Doctor Patient Relationship -List of Offences & Professional Misconduct of Doctors,as per Medical Council of India.

UNIT II: ADVANCED ETHICAL DECISIONS & MAJOR LAWS **9**

Advance decisions to refuse treatment- Doctor and Criminal Abortion- Ethical issues in stroke management- Ethical issues in dementia- Quality of life in healthcare decisions. Prenatal Diagnostic Techniques, Regulations &Prevention of Misuse Act 1994 (PNDT Act) -Transplantation of human organs Act 1994-The Medical Termination Of Pregnancy Act -Labour Laws Applicable to a Hospital-Indian Trade Union Act 1926/Industrial Dispute Act 1947- The Bombay Shops & Establishment Act-The Workmen's Compensations Act- The Industrial Employment (Standing Orders) Act 1946- Payment of Wages Act- Employee Provident Fund Act-Maternity Benefit Act.

UNIT III: ORGANIZATIONAL & PROCEDURAL LAWS **9**

Indian Contract Act- Nursing Home-Registration Ac- Birth-Death Registration Act-Regulation of genetic counseling center - Regulation of pre-natal diagnostic technique - Determination of Sex prohibited - Dying Declaration - Definition - Precautions - Procedure of Recording - Special Circumstances - Importance (Section 32 & 157 of Indian Evidence Act) - Death Certificate - Precautions while issuing death certificate - Contents of Death Certificate - Importance of Death Certificate

UNIT IV: MEDICAL JURISPRUDENCE **9**

Introduction & Legal Procedure - Medico legal aspects of death injuries - General aspects - Medical ethics - Consumer Protection Act- The lawful use of restraints- Quality of life in healthcare decisions-Ethical issues in health and social care.

UNIT V: LEGAL FRAMEWORK FOR HOSPITALS **9**

Introduction to Legal framework - Patient's rights & provider's responsibility - Medical Malpractice- Management of Medical Malpractice - Medico Legal Aspects - Impotence - Sterility - Sterilization & Artificial Insemination - Medico Legal aspects of Psychiatric & mental Health - Toxicology – Laws Relating to Toxicology. - Organ Transplantation Act - Tamil Nadu Clinics Act

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Overcome the barriers of communication and information sharing.
- Gained knowledge about various act involved in taking advanced ethical decisions.
- The course will assist the students in understanding basic laws affecting operations of a Hospital and Healthcare Management.
- Overcome ethical issues in health and social care.
- Possesses good knowledge about legal framework for hospitals.

TEXT BOOKS

1. Jagdish Singh ,'Medical Negligence & Compensation ' 4 th edition,Bharat Law, Jaipur.2021
2. Anoop K. Kaushal ,'Medical Negligence & Legal Remedies' First edition,Universal law,2016

REFERENCES

1. By Dr. C.K. Parikh , ' Parikh's Text Book of Medical Jurisprudence & Toxicology' , CBSPublications.2007.
2. Gurucharan S Sai. 'Medical ethics and Elderly,3rd edition', Radcliffe Publishing Ltd.(2009)

E-RESOURCES

1. https://www.m3india.in/contents/editor_pick/31303/8-essential-pointers-for-issuing-death(Precautions while issuing death certificate)
2. https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/life-quality-i-quality-life-clinical-decisions (- Quality of life in healthcare decisions)

21BATH16 **HEALTHCARE SUPPORT SERVICES** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Understand the structure and functions of different departments of a hospitals and healthcare organizations.
- Develop skills in planning, building and managing hospitals and health care organizations.
- Gain knowledge about hospital hygiene.
- Apply the concepts & techniques of Modern Management in different health care units.
- Acquire knowledge about disaster management.

UNIT I: INTRODUCTION **9**

Introduction to organization of health services in India - Central,States, Defence, Railways and other PSUs- Voluntary agencies- Comprehensive health projects with Rural Development- International organizations related to health services.

UNIT II: MANAGING ENGINEERING &UTILITY SERVICES **9**

Organizing and Managing Facility Support Services - Laundry - Housekeeping - Pest control - Managing the Estate (Hospital Security) - Recent trends in Disaster Management - Hospital Engineering Services (Plumbing, Electricity, Civil, A/C, Lifts) - strategies of hospital equipments- planning and Selection-purchase procedure- installation and commissioning-hospital equipment repair and maintenance quality control.

UNIT III: HOSPITAL HAZARDS **9**

General safety of the patients, fire safety, hospital hygiene, hospital acquired infection, Bio medical waste? handling rule, segregation, collection, transportation, disposal, modern technology, for disposal radioactive waste handling. Review of reports on Healthcare- Bhore Committee-Moodliar Committee-Jain Committee- Kartar Singh Committee- Srivastava Committee

UNIT IV: EVALUATION OF HOSPITAL & HEALTH SERVICES **9**

Accreditation - Setting of Objectives - Health Indicators - Applying Economic Concepts to Service Evaluation - Assessing Patient Satisfaction - Techniques of Hospital Services Evaluation - Indicators of Hospital Efficiency & Effectiveness - Evaluation of Quality of Hospital Services - Management of Hazard & Safety in a Hospital Setup - Nursing Services in a Hospital - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management - Organ Transplantation - RehabilitationServices - Health Insurance & Managing Health Care - Medical Audit - Hazard and Safety in a hospital Setup.

UNIT V: MANAGING SERVICES IN CRISIS **9**

Epidemiological Triad, Levels of Disease Prevention- Disaster Management/ Disaster Plan- Fire fighting- Dealing with crisis situations- Natural disasters -floods, earthquakes etc.- Mob violence against medical establishments- Bomb threat- Terrorist strike- Political agitation- Mass casualties

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understand origin of Hospitals and its step by step development and types.
- Understand the different departmentation of Hospitals based on the service.
- Understand the administrative aspects of multiple clinical services in the Hospital.
- Understand the administrative aspects of different support services in the Hospital.
- Overcome managing services in critical situation.

TEXT BOOKS

1. Arnold D. Kaluzny& Stephen M. Shortell, Health Care Management.%th Edition,DCL,2005.
2. Carolyn SemplePiggot& Carolyn S.Piggot, 'Business Planning for Health Care Management.'Open University Press ,2000

REFERENCES

1. David E.Cope, Organization Development and Action Research in Hospitals. Ashgate Publishing Limited,1981
2. Nancy North ,'Perspectives in health care ' Macmillan Press, U.K,1997

E-RESOURCES

1. https://www.nhp.gov.in/sites/default/files/pdf/Srivastava_Committee_Report.pdf(Srivastava Committee)
2. https://meridian.allenpress.com/bit/article/40/3/233/200484/Medical-Equipment-Management-Strategies (strategies of hospital equipments)

21BATL01 SUPPLY CHAIN CONCEPTS AND PLANNING L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Describe the drivers of the supply chain.
- Describe the concepts employed in the supply chain.
- Gain knowledge about drivers of logistics and forecasting techniques.
- Understand process of sales and operation.
- Learn about Role of ERP in Planning and scheduling.

UNIT I: CONCEPTS OF SUPPLY CHAIN 9

Service and manufacturing supply chain dynamics - Evolution of supply chain management - Multiple views and flows - Service supply chains -Manufacturing supply chains - Measures of supply chain performance - Differentiation-Bullwhip effect

UNIT II: SUPPLY CHAIN PROCESSES AND STRATEGIES 9

Integrated supply chains design - Customer relationship process - Order fulfillment process - Supplier relationship process - Supply chain strategies - Strategic focus - Mass customization - Lean supply chains - Outsourcing and off shoring - Virtual supply chains.

UNIT III: SUPPLY CHAIN PERFORMANCE DRIVERS AND FORECASTING 9

Drivers of supply chain performance - Logistics drivers (Location, inventory and transportation) - Cross functional drivers (Pricing, information and sourcing) — Forecasting introduction - Framework for a forecast system - Choosing right forecasting technique - Judgment methods (Composite Forecasts, Surveys, Delphi Method, Scenario Building, Technology Forecasting, Forecast by Analogy) - Causal methods (Regression Analysis -Linear & Non-Linear Regression, Econometrics) - Time series analysis (Autoregressive Moving Average (ARMA), Exponential Smoothing, Extrapolation, Linear Prediction, Trend Estimation, Growth Curve, Box-Jenkins Approach) — CPFR

UNIT IV: SALES AND OPERATIONS PLANNING 9

Introduction to Sales and operations planning - Purpose of sales and operations plans -Decision context - Sales and operations planning as a process - Overview of decision support tools

UNIT V: RESOURCE PLANNING AND SCHEDULING **9**

Enterprise resource planning - Planning and control systems for manufacturers – Materials requirement planning - Drum – Buffer – Rope system – Scheduling - Scheduling service and manufacturing processes - Scheduling customer demand - Scheduling employees - Operations scheduling.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Identify the concepts of supply chain.
- Analyze supply chain dynamics and various strategies for supply chain performance.
- Understanding drivers of supply chain performance and forecasting.
- Gain knowledge to context of decision relate sales and operation planning.
- Evaluate the role of ERP in Planning and control.

TEXT BOOKS

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 2010.
2. Janat Shah, Supply Chain Management, Pearson Education India, 2009

REFERENCES

1. Chandrasekaran,N ,'Supply Chain management' Oxford University Publications, 2010
2. B S SAHAY Supply Chain Management for The 21st Century. Macmillan Education, 2001

E-RESOURCES

1. https://www.cips.org/knowledge/procurement-topics-and-skills/operations management/material-requirements-planning/(Materials requirement planning)
2. https://www.sciencedirect.com/science/article/abs/pii/S0263876216000782(Integrated supply chains design)

21BATL02 **WAREHOUSE MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Help the students in explaining the significance of Warehousing.
- Provide timely customer service.
- Keep track of items so they can be found readily & correctly.
- Minimize the total physical effort.
- Minimize the cost of moving goods in & out of stage.

UNIT I: INTRODUCTION WAREHOUSING **9**

Introduction Warehousing – Basic Warehousing Decisions – Warehouse Operations – Types ofWarehouses – Functions – Centralized & Decentralized – S rage Systems – Warehousing CostAnalysis – Warehouse Layout – Characteristics if Ideal Warehouse

UNIT II: INVENTORY MANAGEMENT **9**

Inventory: Basic Concepts – Role in Supply Chain – Role in Competitive Strategy – Independent Demand Systems — Dependent Demand Systems — Functions — Types _ Cost — Need for Inventory — Just in Time

UNIT III: INVENTORY CONTROL **9**

Inventory Control – ABC Inventory Control – Multi-Echelon Inventory Systems – DistributionRequirement Planning – Bull Whip Effect – Using WMS for Managing Warehousing Operations **UNIT IV: MATERIALS HANDLING** **9**

Principles and Performance Measures Of Material Handling Systems – Fundamentals of Material Handling – Various Types of Material Handling Equipments – Types of Conveyors – Refrigerated Warehouses- Cold Chain- Agri SCM

UNIT V: MODERN WAREHOUSING METHODS **9**

Modern Warehousing – Au mated S rage & Retrieval Systems & their Operations – Bar Coding Technology & Applications in Logistics Industry — RFID Technology & Applications — Advantages of RFID

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Get complete insight in to warehouse concepts.
- Understanding basic concepts of inventory and role of competitive strategy.
- Know various inventory control techniques and application of inventory management in supply chain.
- Learning Principles and Performance Measures Of Material Handling Systems.
- Get complete insight of different kind of modern warehousing techniques.

TEXT BOOKS

1. Vinod.V.Sople, Logistics Management, Pearson Education, 2004.
2. Arnold, Introduction Materials Management, Pearson Education, 2009.

REFERENCES

1. Frazelle, World Class Warehousing & Material Handling, Tata McGraw-Hill, 2008
2. Satish K. Kapoor and PurvaKansal, Basics of Distribution Management - A Logistical Approach, Prentice Hall, 2003

E-RESOURCES

1. https://cleartax.in/s/abc-analysis(ABC Inventory Control)\
2. https://www.mheda.org/education/material-handling-fundamentals/ - (Fundamentals of Material Handling)

21BATL03 TRANSPORTATION AND DISTRIBUTION MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Explore the fundamental concepts of transportation and distribution management.
- Gain knowledge in network planning, routing and scheduling and application of IT in transportation and distribution management.
- Learn about basic concepts of logistics and its principles.
- Understand trends in international transport concept and its types.
- Aware about role of information technology in transportation and distribution.

UNIT I: DISTRIBUTION **9**

Role of Distribution in Supply chain, Distribution channels – Functions, resources, Operations in Distribution, Designing Distribution network models - its features - advantages and disadvantages.

UNIT II: PLANNING **9**

Distribution network planning, Distribution network decisions, Distribution requirement planning (DRP)

UNIT III: TRANSPORTATION **9**

Role of Transportation in Logistics and Business, Principle and Participants-Scope and relationshipwith other business functions, Modes of Transportation - Mode and Carrier selection, Routing and scheduling.

UNIT IV: TRANSPORTATION **9**

International transportation, Carrier, Freight and Fleet management, Transportation management systems-Administration, Rate negotiation, Trends in Transportation.

UNIT V: INFORMATION TECHNOLOGY (IT) **9**

Usage of IT applications -E commerce — ITMS, Communication systems-Automatic vehicle location systems, Geographic information Systems.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Gain knowledge about the distribution requirements planning.
- Predict the scope and relationship of transportation with other business functions.
- Make use of the advantages and disadvantages of the various models.
- Gain knowledge of International transportation trends
- Aware about usage of Information technology

TEXT BOOKS

1. Raghuram and N. Rangaraj, Logistics and Supply chain Management — Leveraging Mathematical and Analytical Models: Cases and Concepts, New Delhi: Macmillan, 2000.
2. Janat Shah, Supply Chain Management, Pearson Education India, 2009.

REFERENCES

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 2010.
2. Michael B Stroh, Practical Guide to Transportation and Logistics, Logistics Network, 2006.

E-RESOURCES

1. https://www.linkedin.com/pulse/role-distribution-strategy-supply-chain-management-rahul-mehra(Role of Distribution in Supply chain)
2. https://www.saloodo.com/logistics-dictionary/international-transportation/(International transportation,)

21BATL04 REVERSE AND CONTRACT LOGISTICS L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Prepare students successfully implement a contract logistics and closed supply chain in Retail, FMCG and Automobile sectors.
- Discuss the concept and principle of contract logistics and closed supply chain.
- Understand trends and opportunities business and market.
- Gain Knowledge of emerging trends of retail and logistics.
- Know the basic concepts of managing process of third party service.

UNIT I: CONTRACT LOGISTICS 9

Third party logistics industry overview - A framework for strategic alliances - Evolution of contract logistics - Types of third party logistics providers – Automobile, FMCG and Retail-Third party services and integration

UNIT II: CLOSED LOOP SUPPLY CHAINS AND LOGISTICS 9

Introduction closed loop supply chains and logistics — Logistics and closed loop supply chain service - Overview of return logistics and closed loop supply chain models — Introduction product returns - Product Vs Parts returns - Strategic issues in closed loop supply chains

UNIT III: BUSINESS AND MARKET 9

Overview - Introduction life cycle management - Trends and opportunities — Auto Warranty management, return process and benchmarks - Market overview - Reasons for using reverse logistics - General characteristics - Consumer goods Depot repair and value added services - Operating dynamics - Competitive evaluation - Secondary markets and final disposal.

UNIT IV:EMERGING TRENDS 9

Emerging trends in Retail, E-Commerce- FMCG and Automobile sectors- Systems and technology - For consumer goods operations, High tech logistics system - Impact and value of advanced logistics

UNIT V: MANAGING PROCESSES 9

Managing processes - Step by step process - Use of third party service providers - Additional factors – Contemporary issues – Make in India and its impact on Countries GDP and Economic

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understanding the evolution of contract logistics, third party logistics industry and third party logistics providers.
- It helps to gain knowledge about loop logistics and its strategic issues.
- Know about overview of market and reverse logistics.
- Gain knowledge about emerging trends in logistics.
- Understanding make in india and its impact on GDP and Economic growth.

TEXT BOOKS

1. Janat Shah, Supply Chain Management: Text and Cases, Pearson Education India, 2009
2. John Manners-Bell, Logistics and Supply Chains in Emerging Markets, Kogan Page, 2014.

REFERENCES

1. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011
2. D. F. Blumberg, Reverse Logistics & Closed Loop Supply Chain Processes, Taylor and Francis, 2005Hsin-I Hsiao, Wageningen, Logistics Outsourcing in the Food Processing Industry,Academic Pub, 2009.

E-RESOURCES

1. http://www.cargroup.org/wp-content/uploads/2017/02/The-Warranty-Process-Flow-within-The-Automotive-Industry.pdf(Auto Warranty management)
2. https://www.transmetrics.ai/blog/supply-chain-logistics-technology-trends/(Hightech logistics system)

21BATL05 SUPPLY CHAIN INFORMATION SYSTEM L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Know the various technological aspects in the different logistical background.
- Discuss the real time description updated technologies in the logistics sector and SCM.
- Understand steps involved in system development.
- Draw architecture of Supply chain Management information system.
- Understand Enterprise application integration and supply chain visibility.

UNIT I: ELECTRONIC SCM, COMMUNICATION NETWORKS 9

Introduction e-SCM — e-SCM framework - Key success factors for e-SCM - Benefits of e-SCM- Positioning information in Logistics - Strategic information linkage - Supply chain communication networks - Role of communication networks in supply chains - Overview of telecommunication networks –EDI - Data security in supply chain networks - Overview of internet able models

UNIT II: ENTERPRISE INFORMATION SYSTEMS 9

Overview of enterprise information systems - Information functionality and principles - Introduction enterprise information systems -Classification of enterprise information systems- Information architecture -Framework for managing supply chain information - Describe on popular enterprise application packages -Benefits of enterprise information systems

UNIT III: SCM SYSTEMS DEVELOPMENT 9

Stakeholders in supply chain information systems - Stakeholders in SCM - Information systems development- Logistics information systems design- Defining enterprise architecture - Choosing appropriate system development methodologies - Adopting relevant systems development model

UNIT IV: SCM SYSTEMS DEPLOYMENT AND MANAGEMENT 9

Information systems deployment - IT Operations and infrastructure management - Portfolio, programme and project management - Management of risk - Management of value

UNIT V: INFORMATION INTEGRATION **9**

Enterprise application integration and supply chain visibility - Enterprise application integration - Supply chain visibility - Supply chain event management -Supply chain performance -Planning and design methodology - Problem definition and planning - Data collection and analysis - Recommendations and implementation -Decision support systems

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understanding the various enterprise information system and its architecture and benefits.
- Gain knowledge about various e-commerce models, e-SCM, benefits and communication networks.
- Identify different kind of stakeholders in Supply Chain Management.
- Gain knowledge about Portfolio, programme and project management.
- Understanding structure of data collection and analysis.

TEXT BOOKS

1. Bowersox & Closs, Logistical Management, McGraw-Hill Companies, 1996.
2. R.H.Ballou, Business Logistics Management, Prentice-Hall, 2004.

REFERENCES

1. Strauss,E-Marketing, 4/e, Pearson Education 2008
2. Chaffey, E- Business and E- Commerce Management, 3/e, Pearson Education 2008

E-RESOURCES

1. 1.https://searcherp.techtarget.com/definition/supply-chain-visibility-SCV - (Supply chain visibility**)**
2. https://en.wikipedia.org/wiki/Risk_management(Management of risk)

21BATL06 **EXIM MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Enlighten the students about the major functions in export and import processes.
- Gain the expertise for solving issues related to requirements in EXIM management**.**
- Understand the procedure for documentation and customs clearance.
- Learn about payment methods in foreign trade and financing strategies.
- Identify service providers and their role in import and export.

UNIT I: FUNDAMENTALS OF IMPORT AND EXPORT **9**

Role of Import and Export Trade in an Economy - Institutional Framework for Foreign trade in India -Role of Director General of Foreign Trade and Commerce - Objectives of EXIM Policy - Global trade flows - Contract of International Sale of Goods - INCOTERMS 2020

UNIT II: OVERVIEW OF EXPORT AND IMPORT **9**

Marketing for Exports - Negotiation and finalization of Export contract - Export Documentation Procedures - Cargo Insurance - Export Promotion Councils and incentive schemes- Role of Logistics in Exports- Export Houses / Trading Houses

UNIT III: DOCUMENTATION FRAMEWORK **9**

Import for industrial use / trading - Import Documentation and Customs clearance procedures - Types of Imports - Import Licenses - Cargo Insurance - Role of Logistics in Import

UNIT IV: CREDIT AND PAYMENTS **9**

Payment methods in Foreign Trade - Documentary Credit / Letter of Credit–LOU-UCP 600 with respect to Shipping Documents and L/C Negotiation — Export / import financing strategies - Managing payment risks.

UNIT V: CUSTOMS CLEARANCE AND AGENCIES **9**

Roles of Service providers in EXIM transactions – Global Traders – Commodity Brokers - Custom House Agents – Transport Operators – Freight Forwarders – Warehousing and 3PL service providers – Liners /Ship Agencies – Container Freight Stations - Port – Inspection Agencies/ surveyors – Quarantine Agencies – Pest Control Agencies – Chamber of Commerce.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Be aware about the formalities of export and import industry.
- Comprehend the importance of exim management.
- Know about types of insurance ,licenses and documentation.
- Understanding risk associated with payments for foreign trade.
- Acquire knowledge about payers of international trade.

TEXT BOOKS

1. Justin Pauland Rajiv Aserkar, Export Import Management, Second Edition, Oxford University Press, 2013.
2. UshaKiranRai, Export - Import and Logistics Management, Second Edition, PHI Learning, 2010

REFERENCES

1. Director General of Foreign Trade, Foreign Trade Policy and Handbook of Procedures, 2015
2. Coyle et.al, Management Of Transportation, 7th Edition, Cengage Learning, 2011

E-RESOURCES

1. https://en.wikipedia.org/wiki/Freight_forwarder(Freight Forwarders)
2. https://en.wikipedia.org/wiki/Commodity_broker(Commodity Brokers)

21BATI01 INFRASTRUCTURE PLANNING, SCHEDULING AND CONTROL L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Give an exposure to the students on the concept and the principles of planning, scheduling and control about infrastructure industry.
- Understand the issues and benefits related to privatization of projects.
- Know the risks associated with infrastructure projects.
- Able to designing framework for risk management.
- Discuss about innovative design and maintenance of infrastructure facilities.

UNIT I: INTRODUCTION **9**

Introduction to infrastructure - Need and importance of infrastructure in India - Overview of power sector - Overview of water supply and sanitation sector-Overview of road, rail, air and port transportation sectors-Overview of telecommunication sector-Overview of rural and urban infrastructure-Introduction to special economic zones-Organizations and players in infrastructure field -Overview of infrastructure project finance.

UNIT II: INFRASTRUCTURE PRIVATIZATION **9**

Privatization of infrastructure in India - Benefits of privatization-Problems with privatization-Challenges in privatization of water supply projects- Challenges in privatization of power sector projects — Challenges in privatization of road transportation projects.

UNIT III: RISKS IN INFRASTRUCTURE PROJECTS **9**

Economic and demand risks, political risks, socio-economic risks and cultural risks in infrastructure projects -Legal and contractual issues in infrastructure projects- Challenges in construction of infrastructure projects.

UNIT IV: RISK MANAGEMENT FRAMEWORK **9**

Planning to mitigate risk-Designing sustainable contracts-Introduction to fair process and negotiation-Negotiation with multiple stakeholders - Sustainable development- Information technology and systems for successful management.

UNIT V: DESIGN & MAINTENANCE OF INFRASTRUCTURE **9**

Innovative design and maintenance of infrastructure facilities- Modeling and life cycle analysis techniques-Capacity building and improving Government's role in implementation- Integrated framework for successful planning and management.

TOTAL : 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Discuss the basic concepts related to infrastructure and understand management.
- Identify the benefits and problems with infrastructure.
- Identify the challenges and strategies for successful planning and implementation of infrastructure.
- Familiar with role of information technology and system for successful management.
- Apply the above concepts to various infrastructure domains.

TEXT BOOKS

1. Raina V.K, "Construction Management Practice — The inside Story", Tata McGraw Hill Publishing Limited, 2005
2. W.Ronald Hudson, Ralph Haas, Waheed Uddin, "Infrastructure Management: Integrating, Design, Construction, Maintenance, Rehabilitation and renovation", McGraw Hill Publisher, 2013

REFERENCES

1. Prasanna Chandra, "Projects – Planning, Analysis, Selection, Implementation Review", Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
2. Joy P.K., "Total Project Management - The Indian Context", Macmillan India Ltd., 1992

E-RESOURCES

1. https://www.brookings.edu/blog/techtank/2021/02/19/walking-the-talk-infrastructure-privatization-and-digital-in-indias-budget-speeches/(Privatization of infrastructure in India)
2. https://www.constructconnect.com/blog/4-major-challenges-facing-the-construction-industry(Challenges in construction of infrastructure projects)

21BATI02 PROJECT MANAGEMENT FOR INFRASTRUCTURE L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Impart projects types, process and boundaries of project management.
- Know time and tools required for project planning.
- Aware about resource management and techniques for resource smoothing.
- Understand different kind of cost and project cost optimization.
- Familiar with new trends in project management..

UNIT I: PROJECT AND ITS PROCESS 9

Define project and process -Boundaries of project - Objectives and functions of project management -Characteristics and types of projects -Organization structure / styles -Roles of project management group - Project management office and its role - Project knowledge area - Project integration- Process group interaction -project flow - Project life cycle- Influencing factors. - Case study.

UNIT II: PROJECT TIME MANAGEMENT 9

Project scope management - Work break down structure - Activity/Task — Events - Case study - Project planning tools - Rolling wave planning - Gantt charts, Milestone chart, Program progresschart- Creating milestone plan - Project network- Fulkerson's rules - A-O-A and A-O-N networks

- Analyze project time- Critical path method (deterministic approach) - Activity oriented network analysis- 80-20 rule- Case study - Type of time estimates & square network diagram - Project updating and monitoring- Case study - Estimate time- Program Evaluation & Review Technique (Probabilistic approach)- Event oriented network analysis- Optimistic, pessimistic and most likely time - Degree of variability in average time - Probabilistic estimate - % utilization of resources.

UNIT III: RESOURCE MANAGEMENT 9

Types of Resource- Time, Men, Material, Machinery, Money, Space - Balancing of resource - Resource smoothing technique- Time constraint - Resource leveling technique- Resource constraint- Case study.

UNIT IV: RESOURCE OPTIMIZATION **9**

Types of cost — Direct, indirect and total cost - Variation of cost with time - Schedule compression techniques- Crashing, fast tracking & Re-estimation- Crash timeand crash cost - Optimize project cost for time and resource - CPM cost model - Life cycle assessment – Impacts and economical assessment - Life cycle cost- Maintenance and operation -Life cycle forecasting – Concept and applications

UNIT V: EMERGING TRENDS IN PROJECT MANAGEMENT **9**

AGILE Project management and Project Management using latest tools- Case study.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Analyze and manage time in projects through gantt charts, cpm and pert techniques.
- Balance resource requirements of projects so as to avoid idling of resources.
- Update projects and determine revised schedule of activities and critical path, if any,
- Know the methods used for resource optimization.
- Familiar with new trends in project management.

TEXT BOOKS

1. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Fourth Edition,An American National Standard, ANSI/PMI 990001-2008"
2. Jerome D. Wiest and Ferdinand K. Levy, "A Management Guide to PERT/CPM", Prentice Hall of India Publishers Ltd., New Delhi, 1994. .

REFERENCES

1. Srinath L.S., "PERT & CPM- Principles and Applications", Affiliated East West Press Pvt., Ltd., New Delhi, 2008
2. Sengupta. B and Guha. H, "Construction Management and Planning", Tata McGraw Hill, New Delhi, 1995

E-RESOURCES

1. http://atimysore.gov.in/wp-content/uploads/chapter-6-network-analysis-mod.pdf(Activityoriented network analysis)
2. https://www.wrike.com/project-management-guide/faq/what-is-project-integration-management/(Project integration)

21BATI03 URBAN ENVIRONMENT MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Create awareness on the various environmental issues in an urban scenario.
- Give an exposure to the urban water resources and its management.
- Impart knowledge on the stages of works involved in a water supply project of a city, safe wastewater collection system for generated wastewater and its management.
- Discuss about collection, process and disposal of solid waste.
- Analyze about various issues related to environmental ,social and psychological aspects.

UNIT I: URBAN ENVIRONMENTAL ISSUES 9

Urbanization- Population growth scenario -Migration - Pollution of surface water resources - Rivers, tanks, channels -Ground water exploitation - Waste water -Characteristics -Pollution problems - Solid waste -Air pollution - CPCB norms.

UNIT II: URBAN MASTER PLANS 9

Planning and organizational aspects -Urban waste resources management - Water in urban ecosystem -Urban water resources planning and organization aspects -Storm water management practices -Types of storage -Magnitude of storage -Storage capacity of urban components -Percolation ponds -Temple tanks -Rainwater harvesting -Urban water supply - Demand estimation -Population forecasting -Source identification -Water conveyance -Storage reservoirs -Fixing storage capacity - Distribution network -Types -Analysis -Computer applications - Conservation techniques -Integrated urban water planning - Smart city project planning - Green Building - LEED certification - Green audit

UNIT III: URBAN WASTEWATER MANAGEMENT 9

Sewage generation -Storm drainage estimation -Industry contribution -Wastewater collection system -Separate and combined system -Hydraulic design of sewer and storm drain - Wastewater treatment -Disposal methods -Concept of decentralization - 3R concepts.

UNIT IV: MUNICIPAL SOLID WASTE MANAGEMENT 9

Sources of solid waste -Characteristics -Rate of generation -Segregation at source -Collection of solid waste -Methods of collection -Route analysis -Transfer and transfer stations -Processing and disposal of solid waste.

UNIT V: CASE STUDIES **9**

Environmental economics- Social and physiological aspects of pollution - Successful urban management -Models- Urban management-Case studies from developed nations -Software.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understand planning of a city and identify various urban environmental issues
- Apply and prepare project plans to integrate urban water resource
- Develop water resource management using available water resources.
- Aware about management of solid waste.
- Able to find solution for social and psychological issues.

TEXT BOOKS

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil "Integrated Solid Waste Management", McGraw Hill Publishers, New York, 1993.
2. McGhee J., "Water supply and sewerage", McGraw Hill Publishers, 1991

REFERENCES

1. Martin P. Wanelista and Yousef. "Storm Water Management and Operations", John Wiley and Sons, 1993.
2. Neil S. Grigg., "Urban Water Infrastructure Planning – Management and Operations", JohnWiley and Sons, 1986.

E-RESOURCES

1. http://www.gdrc.org/uem/waste/waste.html(Urban waste resources management)
2. https://www.britannica.com/technology/solid-waste-management/Solid-waste-collection(Collection of solid waste)

21BATI04 REAL ESTATE MARKETING AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Provide good knowledge on real estate marketing and management.
- Understand sequential events in real estate.
- Familiar with approval process of real estate development.
- Know about resource mobilization techniques for construction management.
- Able to effectively presenting the project to the target audience.

UNIT I: CONCEPT 9

Fundamental concepts and techniques involved in real estate development process- Role of various organizations - CREDAI- BAI etc

UNIT II: EVENTS AND PRE-PROJECT STUDIES 9

Modeling sequential events in real estate development process - Site evaluation - Land procurement - Development Team assembly - Market study

UNIT III: DEVELOPMENT PLANNING & APPROVAL PROCES 9

Identifying technical inputs required, planning objectives, front end clearances from various authorities, timing of the project and scheduling

UNIT IV: CONSTRUCTION AND PROJECT MANAGEMENT 9

Identifying the elements of infrastructure and the resource mobilization, disaggregating the project components, mobilizing the human and fiscal resources procuring and storing materials

UNIT V: PROJECT MARKETING & HANDING OVER 9

Over of the completed project- Communication tools required for presenting the project -In house sales promotion -Franchisee system -Joint venture and sharing issues - Procedure and laws relating to transfer of completed project.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Familiar with basic concepts of real estate development.
- know the fundamental concepts and techniques involved in real estate development process.
- Know the process involved in approval process.
- Identify the fiscal resources procuring and storing materials process.
- Discuss the procedure and laws relating to transfer of completed project

TEXT BOOKS

1. Gerald R. Cortesi, "Mastering real estate principles" ; Dearborn Trade Publising, New York, USA.,2001.
2. Fillmore W Galaty, "Modern real estate practice",Dearborn Trade publishing, New York, USA,2002.

REFERENCES

1. Tanya Davis, "Real estate developer's handbook" , Atlantic pub company, Ocala, USA.2007.
2. Mike E. Miles, "Real estate development - Principles & process 3rd edition" Urban Land Institute, ULI, Washington DC.2000.

E-RESOURCES

1. https://www.ipinfusion.com/blogs/ip-infusion-network-disaggregation-blog-series/(disaggregating the project components,)
2. https://www.infoentrepreneurs.org/en/guides/joint-ventures-and-partnering/-(Jointventureand sharing issues)

21BATI05 DISASTER MITIGATION AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Create awareness on the various types of disasters and to expose the students about the measures.
- Aware about causes and reasons for earthquake.
- Impart knowledge on the methods of mitigating various hazards such that their impact on communities is reduced.
- Know the techniques available for hazard assessment.
- Familiar with policy for disaster management and regulations.

UNITI: INTRODUCTION 9

Difference between hazards and disaster -Types of disasters-Phases of disaster management - Hazards - Classification of hazards - Hazards affecting buildings - Building safety against hazards - Floods - Cyclone - Landslides -Tsunami - Fire.

UNIT II: EARTHQUAKE DISASTER 9

Earthquake hazard map -Causes of earthquakes -Classification of earthquakes -Seismic waves -Energy release - Inertia forces - Natural period - Resonance - Damping -Seismic response of free vibration -Seismic response of damped vibration -Performance of ground and buildings in past earthquakes-Earthquake resistant measures in RC and masonry buildings - Potential deficiencies of RC and masonry buildings.

UNIT III: OTHER DISASTERS 9

Landslides-Landslide zoning map - Causes -Protection measures Floods -Flood zone map - Effects on buildings -Protection measures from damage to buildings -Mitigation strategies - Tropical cyclones - Effects on buildings -Protection measures from damage to buildings - Tsunami -Tsunami wave characteristics -Peculiarities of tsunami deposits -Tsunami impact on coastal lines-Effects of Tsunami on built structures - Fire disaster - Causes and effects of fire disaster - Preventive mechanism .

UNIT IV: HAZARD ASSESSMENT 9

Visual inspection and study of available documents -Detailed in-situ investigation planning and interpretation of results-Foundation capability -Non-structural components - Seismic strengthening of buildings –Repairs, restoration and strengthening of existing buildings - Strengthening materials -Retrofitting of load bearing wall buildings - Retrofitting of RC Buildings-

RVS method of screening - RC and masonry structures -Seismic hazard assessment - Deterministic seismic hazard analysis - PSHA.

UNIT V: LAND USE ZONING REGULATIONS , QUALITY CONTROL AND DISASTER MANAGEMENT POLICY 9

Introduction-Community planning - Community contingency plan - Report building and initial awareness - Recommendations for land use zoning regulations - Construction quality control - Evolution of quality management -Reasons for poor construction -Construction of quality control in masonry structures - Disaster management policy and procedure -Legal frame work - Institutional mechanism - Schemes and grants on DM - Recommendation of 13th finance commission -Plan schemes - Non plan schemes - Externally aided schemes Role of NDRF in Disaster Management - Medical First Responder - Flood Rescue &Relief Management.

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Identify difference between disaster and hazards.
- Understand the various types of disaster viz hydrological, coastal and marine disasters, atmospheric disasters, geological, mass movement and land disasters, wind and water driven disasters.
- Identify the potential deficiencies of existing buildings for eq disaster and suggest suitable remedial measures.
- Derive the guide lines for the precautionary measures and rehabilitation measures for eq disaster.
- Understanding awareness measures and quality management.

TEXT BOOKS

1. Annual Report, Ministry of Home Affairs, Government of India, 2009-10
2. Ayaz Ahmad, "Disaster Management: Through the New Millennium" Anmol Publications, 2003

REFERENCES

1. Ghosh G.K. "Disaster Management", A.P.H. Publishing Corporation, 2006
2. Singh R.B, "Disaster Management", Rawat Publications, 2008

E-RESOURCES

1. https://en.wikipedia.org/wiki/Tropical_cyclone(Tropical Cyclones)
2. https://en.wikipedia.org/wiki/Damping(Damping)

21BATI06 VALUATION OF REAL ESTATE AND INFRASTRUCTURE ASSETS L T P C
3 0 0 3

OBJECTIVES

The objective of this course will enable students to:

- Know the concepts and scope of valuation and types of values.
- Identify approaches available to real estate valuation.
- Gain knowledge about the valuation of different infrastructure assets.
- Identify different categories of infrastructure assets.
- Discuss about different infrastructure sectors and its valuation.

UNIT I: REAL ESTATE VALUATION 9

Scope and objectives -Concepts of valuation - Types of value - Value vs Price vs Cost-Different methods of valuation- SWOT analysis

UNIT II: APPROACHES TO REAL ESTATE VALUATION 9

Sales comparison approach - Cost approach - Income approach - SWOT analysis

UNIT III: VALUATION OF VARIOUS CATEGORIES OF REAL ESTATE 9

Residential real estate valuation - Commercial real estate valuation - Industrial real estate valuation - Retail real estate valuation- Mixed-use real estate valuation

UNIT IV: INFRASTRUCTURE ASSET VALUATION 9

Objective and approaches-Different categories of infrastructure assets- Valuation methodology-Key operational and financial parameters -Valuation framework and models.

UNIT V: SECTORAL INFRASTRUCTURE VALUATION 9

Power sector- IT sector - Telecom sector - Aviation-Education sector- Other service sectors-Plant and Machinery -Case studies

TOTAL: 45 PERIODS

OUTCOMES

On Completion of this course, the student will be able to:

- Understanding basic concepts of valuation.
- Familiar with different approaches of real estate valuation.
- Gain knowledge and skills in connection to the valuation of different types of real estates.
- Know the objectives of classification of infrastructure and methodology of valuation.
- Know different sector of infrastructure and its valuation.

.

TEXT BOOKS

1. Frederic Blanc - Brude and Majid Hasan ,'Infrastructure valuation', EDHEC Risk Institute,2015
2. Frederic Blanc - Brude and Majid Hasan ,'Infrastructure Asset Management' EDHEC RiskInstitute,2013

REFERENCES

1. Michael J. Garvin, Valuation techniques for infrastructure investment decisions', Columbia University,2004
2. Frédéric Blanc-Brude and Majid Hasan, 'Infrastructure valuation' EDHEC-Risk Institute ,2015

E-RESOURCES

1. https://www.thebalance.com/different-types-of-real-estate-investments-you-can-make-357986 (Real estate investment)
2. http://rbsa.in/valuation_of_infrastructure_assets_specialized_assets.html - (Valuation of infrastructure)

SEMESTER II

OPEN ELECTIVE – I

21PGO201 DISASTER MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

The student can be able to,

- Provide basic conceptual understanding of disasters.
- Understand approaches of Disaster Management.
- Build skills to respond to disaster.
- Manage the disasters in predictable areas.
- Assess the risk of Disasters.

UNIT I: INTRODUCTION 9

Definition and types of disaster Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.

UNIT II: TYPES OF DISASTERS 9

Study of Important disasters Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters.

UNIT III: DISASTER MANAGEMENT 9

Mitigation and Management techniques of Disaster Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, Building design and construction in highly seismic zones, retrofitting of buildings.

UNIT IV: DISASTER AWARENESS 9

Training, awareness program and project on disaster management Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management.

UNIT V: RISK ASSESSMENT **9**

Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students should be able to:

- Provide basic conceptual understanding of disasters.
- Understand approaches of Disaster Management.
- Build skills to respond to disaster.
- Be aware of the disasters.
- Assess the risk behind the disaster.

TEXT BOOKS

1. "Disaster Management Guidelines", GOI-UND Disaster Risk Program (2009-2012).
2. Damon, P. Copola, "Introduction to International Disaster Management", Butterworth Heineman, 2006.

REFERENCES

1. Gupta A.K., Niar S.S and Chatterjee S. "Disaster management and Risk Reduction, Role of Environmental Knowledge", Narosa Publishing House,2013.
2. Murthy D.B.N.,"Disaster Management", Deep and Deep Publication PVT. Ltd. New Delhi, 2013.

E – RESOURCES

1. https://nptel.ac.in/courses/124/107/124107010/ (Disaster Management)
2. https://onlinecourses.swayam2.ac.in/cec19_hs20/preview (Introduction)

21PGO202 COST MANAGEMENT OF ENGINEERING PROJECTS L T P C
3 0 0 3

OBJECTIVES

The student will be able to,

- Acquire knowledge about cost management.
- Understand the various cost for a project.
- Know the commissioning by means of various analysis.
- Practice the quantitative methods of cost calculation.
- Simulate the techniques for cost management.

UNIT I: INTRODUCTION **9**

Introduction and Overview of the Strategic Cost Management Process Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT II: PROJECT **9**

Meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities.Detailed Engineering activities. Pre project execution main clearances and documents - Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram.

UNIT III: PROJECT COMMISSIONING **9**

mechanical and process Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems.Standard Costing and Variance Analysis.

UNIT IV: PRICING STRATEGIES **9**

Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT V: QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT **9**

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students should be able to,

- Acquire knowledge about cost management.
- Understand the various cost for a project.
- Know the commissioning by means of various analysis.
- Practice the quantitative methods of cost calculation.
- Simulate the various techniques for cost manament.

TEXT BOOKS

1. Charles T. Horngren, Srikant M. Datar and Madhav V. Rajan, "Cost Accounting A Managerial Emphasis", 14th Edition, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" 13th Edition, 2008.

REFERENCES

1. Robert S Kaplan ,Anthony A. Alkinson, "Management & Cost Accounting" , 4th Edition, Pearson Education, Delhi.
2. Ashish K. Bhattacharya, "Principles & Practices of Cost Accounting", A. H. Wheeler publishers.

E – RESOURCES

1. https://nptel.ac.in/courses/105/106/105106149/ (Types of Projects)
2. https://nptel.ac.in/courses/110/104/110104073/ (Cost Management for Projects)

21PGO203 **CONSTITUTION OF INDIA** **L T P C**
3 0 0 3

OBJECTIVES

The main objective of this course is to,

- Understand the Meaning of the constitution law and constitutionalism.
- Realize the fundamental rights.
- Understand the execution powers of union and states.
- Be aware of the Constitutional powers.
- Acquaint with other Constitutional Functionaries.

UNIT I: INTRODUCTION **9**

Meaning of the constitution law and constitutionalism – Historical perspective of the Constitution of India — Preamble — Salient features and characteristics of the Constitution of India — Citizenship.

UNIT II: FUNDAMENTAL RIGHTS **9**

Scheme of the fundamental rights – The scheme of the Fundamental Duties and its legal status – The Directive Principles of State Policy – Its importance and implementation.

UNIT III: UNION AND STATE EXECUTIVE **9**

Federal structure and distribution of legislative and financial powers between the Union and the States – Parliamentary Form of Government in India – The constitution powers and status of the President of India – Governor – Appointment, Powers and Functions.

UNIT IV: CONSTITUTIONAL POWERS **9**

Amendment of the Constitutional Powers and Procedure — The historical perspectives of the constitutional amendments in India — Emergency Provisions : National Emergency, PresidentRule, Financial Emergency.

UNIT V: OTHER CONSTITUIONAL FUNCTIONARIES **9**

Election Commission of India: Organization, Powers and Functions, Union Public Service Commission, State Public Service Commission – Local Self Government.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the students will be able to,

- Understand the Salient features and characteristics of the Constitution of India.
- Analyze the scheme of the Fundamental rights and Duties.
- Evaluate the powers between the Union and the States.
- Know the concept of Constitutional Powers.
- Recognize other constitutional functionaries.

TEXT BOOKS

1. Durga Das Basu, "Introduction to the Constitution of India", 24th Edition,Lexis Nexis Publishers, 2019.
2. Subhash by C. Kashyap," Our Constitution",National Book Trust, 2019.

REFERENCES

1. M.Laxmikanth,"Indian Polity", 5th Edition, Spectrum Publishers,2016.
2. Granville Austin, "The Indian Constitution: Cornerstone of a Nation", Classic Reissue,Oxford India Publishers,1999.

E – RESOURCES

1. https://www.youtube.com/watch?v=vq2Q1_v6TNU (Constitution)
2. https://www.india.gov.in/my–government/constitution–india/constitution–india–full–text (Fundamental Rights)

21PGO204 **BUSINESS ANALYTICS** **L T P C**
3 0 0 3

OBJECTIVES

The student will be able to,

- Understand the different basic concept / fundamentals of business statistics.
- Understand the importance of measures of Descriptive statistics which includes measures of central tendency, Measures of Dispersion, Time Series Analysis, Index Number, Correlation and Regression analysis and their implication on Business performance.
- Understand the concept of Probability and its usage in various business applications.
- Understand the Hypothesis Testing concepts and use inferential statistics- t, F, Z Test and Chi Square Test.
- Understand the practical application of Descriptive and Inferential Statistics concepts and their uses for Business Analytics.

UNIT I: BUSINESS ANALYSIS **9**

Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst. Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

UNIT II: LIFE CYCLES **9**

Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

UNIT III: FORMING REQUIREMENTS **9**

Overview of Requirements, Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.

UNIT IV: TRANSFORMING REQUIREMENTS **9**

Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

UNIT V: FINALIZING REQUIREMENTS **9**

Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students should be able to

- Understand the different basic concept / fundamentals of business statistics.
- Understand the importance of measures of Descriptive statistics which includes measures of central tendency, Measures of Dispersion, Time Series Analysis, Index Number, Correlation and Regression analysis and their implication on Business performance.
- Understand the concept of Probability and its usage in various business applications.
- Understand the Hypothesis Testing concepts and use inferential statistics- t, F, Z Test and Chi Square Test.
- Understand the practical application of Descriptive and Inferential Statistics concepts and their uses for Business Analytics.

TEXT BOOKS

1. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey," Business analytics Principles, Concepts, and Applications", Pearson FT Press.2014
2. James Evans," Business Analytics",2nd edition Pearsons Education.2016.

REFERENCES

1. Swain Scheps , "Business Intelligence for Dummies",2008.
2. S.Christian Albright and Wayne L. Winston, "Business Analytics:Data Analysis and Decision Making", 2016.

E – RESOURCES

1. https://nptel.ac.in/courses/110/105/110105089/ (Business Intelligence)
2. https://onlinecourses.nptel.ac.in/noc20_mg11/preview (Business Analytics)

21PGO205 **DIGITAL MARKETING** **L T P C**
3 0 0 3

OBJECTIVES

This course will enable the students to,

- Acquaint the learners to create a structured digital marketing plan and budget.
- Identify the correct measures to set objectives and evaluate digital marketing.
- Review and prioritize the strategic options for boosting customer acquisition, conversion, and retention using digital marketing.
- Aware search engine optimizations.
- Understand the web analytics.

UNIT I: INTRODUCTION & ORIGIN OF DIGITAL MARKETING **9**

Traditional v/s Digital Marketing. Digital Marketing Strategy, The P-O-E-M Framework, Segmenting & Customizing Messages, The Digital landscape, Digital Advertising Market in India. Skills required in Digital Marketing. Digital Marketing Plan.

UNIT II: SOCIAL MEDIA MARKETING **9**

Meaning, Purpose, types of social media websites. Blogging: Types of blogs, Blogging platforms & recommendations. Social Media Engagement, Target audience, Sharing content on social media, Do's and don'ts of social media.

UNIT III: SEARCH ENGINE OPTIMIZATION **9**

Meaning, Common SEO techniques, Understanding Search Engines, basics of Keyword search, Google rankings, Link Building, Steps to optimize website. Basics of Email Marketing: Types of Emails, Mailing List, Email Marketing tools, Email Deliverability & Email Marketing automation.

UNIT IV : FACEBOOK MARKETING **9**

Introduction, Facebook for business.Anatomy of an Ad Campaign, Role of Adverts-Types & Targeting, Adverts Budget & Scheduling, Adverts Objective & Delivery.LinkedIn Marketing-introduction & importance, LinkedIn Strategies, Sales Leads Generation Using LinkedIn, Content Strategies. Mobile Marketing-Introduction, Mobile Usage, Mobile Advertising, Mobile Marketing tool Kit, Mobile Marketing Features.

UNIT V: UNDERSTANDING WEB ANALYTICS **9**

Purpose, History, Goals & objectives, Web Analytic tools & Methods.Web Analytics Mistakes and Pitfalls. Basics of Content Marketing: Introduction, Content marketing statistics, Types of Content, Types of Blog posts, Content Creation, Content optimization, Content Management & Distribution, Content Marketing Strategy, Content creation tools and apps, Challenges of Content Marketing.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students should be able to

- Acquaint the learners to create a structured digital marketing plan and budget.
- Identify the correct measures to set objectives and evaluate digital marketing.
- Review and prioritize the strategic options for boosting customer acquisition, conversion, and retention using digital marketing.
- Aware of Search engine optimizations.
- Understand the web analytics.

TEXT BOOKS

1. Rajendra Nargundkar and RomiSainy "Digital Marketing: Cases from India", Notion Press, 2018.
2. Damian Ryan, "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation" , Kogan Page Publisher Marketing.2008.

REFERENCES

1. Hermawan Kartajaya, Philip Kotler and Iwan Setiawan , "Marketing 4.0 : Moving from Traditional to Digital", Wiley Publisher,2018.
2. Seema Gupta, "Digital Marketing", 2nd Edition, McGraw Hill Education, 2019.

E – RESOURCES

1. https://onlinecourses.swayam2.ac.in/ugc19_hs26/preview (Digital Marketing)
2. https://nptel.ac.in/courses/110/104/110104070/ (Web Analytics)

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

FOR M.E. COMPUTER SCIENCE AND ENGINEERING

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	–	100
21PEE201	Mini Project	EEC	0	0	2	1	100	–	100
21PEE301	Project work (Phase – I)	EEC	0	0	12	6	40	60	100
21PEE401	Project work (Phase – II)	EEC	0	0	24	12	40	60	100

DEPARTMENT OF CIVIL ENGINEERING

FOR M.E. STRUCTURAL ENGINEERING

Course Code	Name of the Subject	Category	Hours / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	–	100
21PEE201	Mini Project	EEC	0	0	2	1	100	–	100
21PEE301	Project work (Phase – I)	EEC	0	0	12	6	40	60	100
21PEE401	Project work (Phase – II)	EEC	0	0	24	12	40	60	100

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FOR M.E. VLSI DESIGN

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
21PEE101	Research Paper Writing and Seminar	EEC	1	0	0	0	100	-	100
21PEE201	Mini Project	EEC	0	0	2	1	100	-	100
21PEE301	Project Work Phase - I	EEC	0	0	12	6	40	60	100
21PEE401	Project Work Phase - II	EEC	0	0	24	12	40	60	100

M.B.A. DEGREE PROGRAMME

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19BAE101	Spoken and Written Communication#	EEC	0	0	4	2	100	-	100
19BAE201	Creativity and Innovation	EEC	0	0	4	2	100	-	100
19BAE301	Summer Training	EEC	0	0	2	1	100	-	100
19BAE401	Project Work	EEC	0	0	24	12	40	60	100

SUMMARY OF CREDIT DISTRIBUTION

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

M.E. COMPUTER SCIENCE AND ENGINEERING

Category	Sem 1	Sem 2	Sem 3	Sem 4	Total
FC	7	-	-	-	**7**
PC	11	10	-	-	**21**
PE	3	6	11	-	**20**
OE	-	3	-	-	**3**
EEC	-	1	6	12	**19**
Total	**21**	**20**	**17**	**12**	**70**

DEPARTMENT OF CIVIL ENGINEERING

FOR M.E. STRUCTURAL ENGINEERING

Category	Sem 1	Sem 2	Sem 3	Sem 4	Total
FC	7	–	–	–	**7**
PC	11	10	–	–	**21**
PE	3	6	11	–	**20**
OE	–	3	–	–	**3**
EEC	–	1	6	12	**19**
Total	**21**	**20**	**17**	**12**	**70**

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

FOR M.E. VLSI DESIGN

Category	Sem1	Sem2	Sem 3	Sem 4	Total
FC	7	-	-	-	**7**
PC	11	10	-	-	**21**
PE	3	6	11	-	**20**
OE	-	3	-	-	**3**
EEC	-	1	6	12	**19**
Total	**21**	**20**	**17**	**12**	**70**

M.B.A. DEGREE PROGRAMME

Category	Sem 1	Sem 2	Sem 3	Sem 4	Total
PC	23	24	6	-	**53**
PE	-	-	18	-	**18**
EEC	2	0	1	12	**15**
Total	**25**	**24**	**25**	**12**	**86**