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

CURRICULUM & SYLLABI

B.E. ROBOTICS AND AUTOMATION

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2023

(I - IV SEMESTER)

(For the Students Admitted in the Academic Year 2023-2024 onwards)

Estd : 2001

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 under the same Regulation as may be decided by the Academic Council.

Chairman - BoS

DEAN (ACADEMICS)
SENGUNTHAR ENGINEERING COLLEGE
TIRUCHENGODE-637 205

PRINCIPAL
SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
TIRUCHENGODE - 637 205

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REGULATIONS

UG REGULATIONS -2023

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REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. E. ROBOTICS AND AUTOMATION

VISION

To develop competent multidisciplinary professionals, researchers and entrepreneurs in the field of Robotics and Automation to cater the needs of the industries and society

MISSION

- To equip students with cutting-edge tools, technologies, and methodologies in Robotics and Automation.
- To establish strong collaborations with industries and research organizations, ensuring practical exposure and problem-solving experiences.
- To nurture leadership qualities, enabling students to lead teams and drive technological advancements in the field.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives (PEOs) broad statements describe the career and professional accomplishments that the graduates are expected to achieve within three to five years after graduation.

Graduates of B.E. - Robotics and Automation program will

PEO 1 : Acquire practical skills and industry-relevant knowledge through active collaboration with leading industries and research organizations

PEO 2 : Engage in continuous learning through professional development and advanced studies to stay updated with emerging technologies

PEO 3 : Develop strong leadership and entrepreneurial skills to lead teams, foster technological innovations, and launch successful ventures in their field

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design / development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct**	Use research-based knowledge and research methods

	investigations of complex problems	including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**	. Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOME (PSOs)

The Program Specific Outcomes (PSOs) are the statements that describe what the graduates of a specific engineering program should be able to do at the time of graduation. On Successful completion of the B.E programme in Robotics and Automation, the graduates will be able to

PSO1	Apply the principles of robotics and automation to solve complex problems using rapid programming
PSO2	Develop products for manufacturing and assembly using line automation.

MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME

Year	Sem	Course Name	PO											PSO			
			1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
I	I	23HST101 - Professional English	1	1	1.5	2	1	-	-	1.8	3	1.5	2	2	-	-	1
		23MAT101 - Matrices and calculus	3	3	2	-	-	-	-	-	-	-	-	2	-	-	3
		23HST102 - தமிழர்மரபு / Heritage of Tamils	-	-	-	-	-	-	-	2	1	2	-	1	-	-	-
		23PHE101 - Engineering Physics	3	3	1	1	-	-	-	-	-	-	-	-	-	-	3
		23CYE101 - Chemistry for Engineers	2.5	2.17	2.67	2.2	2	2	2	1.83	1.6	1.6	1.33	2.33	-	-	2.5
		23GEE101 - Programming in C	2.83	2.83	2.5	1.8	3	-	-	1	1	1.33	1	2	3	2.66	2.83
		23EEC101 - Soft Skills & Life Skills	1.25	1.6	1	1	3	1.4	1.4	2	2.6	2.8	2.6	2	-	-	1.25
		23MDC101 - Induction Program (2 Weeks)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	23MAT201- Statistics and Numerical Methods	3	3	2	2	2	-	-	-	-	-	-	1	-	-	3
		23PHT201- Advanced Physics of Materials	2	3	2	1	1.8	1	1	-	-	-	-	-	-	-	2
		23CYT201- Environmental Sciences and Sustainability	2	1.4	3	2	2.8	3	3	3	2	2.7	2.4	2.2	-	-	2
		23HST102 - தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	-	-	-	-	-	-	-	2	1	2	-	1	-	-	-
		23GET201 Engineering Graphics	3	2	2	-	3	1	-	-	-	-	-	2	2	-	3
		23HSE201 - English for Engineers: Theory and Practice	1	2	-	2	1	2	2	1.5	2.33	3	2	1.66	-	-	1
		23EEE202 Basic Electrical and Electronics Engineering	3	2.5	2	1	-	-	-	1	3	3	-	1	3	3	3

		23GEL201 Engineering Practice Laboratory	3	2	-	-	1	1	1	-	-	-	-	2	-	2	3
		23EEC201 Indian Language (Except Mother Tongue) / Foreign Language															
		Hindi	-	-	-	-	-	1.0	1.0	1.3	1.6	2.8	-	1.6	-	-	-
		German	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	1.6	-	-	-
		Japanese	-	-	-	-	1.4	1.6	1.6	1.0	0.2	2.6	-	1.0	-	-	-
		23MDC201 Aptitude Skills	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
II	III	23MAT304 Transforms and Partial Differential Equations	3	3	2	2	2	-	-	-	-	-	2	3	-	-	3
		23MET301 Engineering Mechanics	3	2	2	-	-	-	-	-	-	-	-	2	-	2	3
		23RMT301 Fundamentals of Robotics and Applications	3	2	-	-	-	2	-	-	-	-	-	2	-	3	3
		23RME301 Digital Electronics And Microprocessor	3	2	1	1	1	1	-	2	1	2	1	1	3	1	3
		23RME30 Electric machines and power system	2.67	2.33	1	1.5	1.83	1	–	1	1	1	1.17	1.17	2	1.67	2.67
		23RME301 Manufacturing Processes and Technology	2.17	1.17	-	-	-	1	-	-	-	-	2	1	2	1.67	2.17
		23EEC302 Professional Development	2.3	1.6	2	2	3	-	-	-	1.5	2.6	1	1	2	2	2.3
	IV	23RMT401 Embedded Systems and Programming	3	2.2	1.33	1.25	2	–	–	1	1	1	1.2	1	2.6	2.2	3
		23RMT402 Sensors and Actuators	3	2.2	1.67	1.25	1.6	–	–	1	1	–	1.2	–	2.4	1.8	3
		23RMT403 Kinematics and dynamics of Robots	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
		23EEE401 PLC and SCADA	2.5	2.17	1.17	1.4	2	3	2	3	1.6	–	1	1	2.33	2.83	2.5
		23MEE402 Strength of Materials	3	3	1	-	-	1	1	-	2	-	-	3	2	2	3

		23GEE301 Problem solving using Python Programming	2.83	2.667	2.16	1.5	2.83	-	-	1	1	1.5	1	2	-	-	2.83
		23EEC401 Online Certification Courses	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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SCHEME FOR CURRICULUM

B.E. –RM (ROBOTICS AND AUTOMATION)

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

B.E - ROBOTICS AND AUTOMATION- FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST101	Professional English	HS	3	0	0	3	40	60	100
23MAT101	Matrices and Calculus	BS	3	1	0	4	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23PHE101	Engineering Physics	BS	3	0	2	4	50	50	100
23CYE102	Chemistry for Engineers	BS	3	0	2	4	50	50	100
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
MANDATORY COURSE									
23MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
TOTAL CREDITS IN SEMESTER - I			21						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E - ROBOTICS AND AUTOMATION- SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT201	Statistics and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT201	Advanced Physics of Materials	BS	3	0	0	3	40	60	100
23CYT201	Environmental Sciences and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
23GET201	Engineering Graphics	ES	3	1	0	4	40	60	100
EMBEDDED COURSE									
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23EEE202	Basic Electrical and Electronics Engineering	PC	3	0	2	4	50	50	100
PRACTICAL									
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
23MDC201	Aptitude Skills	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - II			27						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
GE	:	General Elective
OE	:	Open Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

B.E - ROBOTICS AND AUTOMATION- THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23MAT304	Transforms and Partial Differential Equations	BS	3	1	0	4	40	60	100
23MET302	Engineering Mechanics	ES	3	1	0	4	40	60	100
23RMT301	Fundamentals of Robotics and Applications	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23RME301	Digital Electronics and Microprocessor	PC	3	0	2	4	50	50	100
23RME302	Electric Machines and Power System	PC	3	0	2	4	50	50	100
23RME303	Manufacturing Processes and Technology	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
TOTAL CREDITS IN SEMESTER - III						24			

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E - ROBOTICS AND AUTOMATION- FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23RMT401	Embedded Systems and Programming	PC	3	0	0	3	40	60	100
23RMT402	Sensors and Actuators	PC	3	0	0	3	40	60	100
23RMT403	Kinematics and Dynamics of Robots	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23RME401	PLC and SCADA	PC	3	0	2	4	50	50	100
23MEE402	Strength of Materials	PC	3	0	2	4	50	60	100
23GEE301	Problem solving and Python Programming	ES	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC401	Online Certification Courses	EEC	3	0	0	3	100	-	100
TOTAL CREDITS IN SEMESTER - IV			24						

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
GE	:	General Elective
OE	:	Open Elective
EEC	:	Employability Enhancement Courses
MC	:	Mandatory Courses
L	:	Lecture
T	:	Tutorial
P	:	Practical
C	:	Credit Point
CIA	:	Continuous Internal Assessment
ESE	:	End Semester Examination
TOT	:	Total

B.E - ROBOTICS AND AUTOMATION- FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23RMT501	AI For Robotics	PC	3	0	0	3	40	60	100
23RMT502	Hydraulics and Pneumatics	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
EMBEDDED COURSE									
23RME501	CNC Machines and Technology	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
MANDATORY COURSE									
	Mandatory Course - I	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - V			21						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E - ROBOTICS AND AUTOMATION- SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
	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
	Open Elective-I/NCC - L1/ L3	OE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23RME601	Automation System Design	PC	3	0	2	4	50	50	100
23RME602	Electric Drives and Control	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ601	Project Work – Phase I	EEC	0	0	8	4	60	40	100
MANDATORY COURSE									
	Mandatory Course - II	MC	3	0	0	0	-	-	-
TOTAL CREDITS IN SEMESTER - VI			24						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E - ROBOTICS AND AUTOMATION- SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100
	Elective-Management	GE	3	0	0	3	40	60	100
	Open Elective-II/NCC-II L2/ L4	OE	3	0	0	3	40	60	100
	Open Elective-III	OE	3	0	0	3	40	60	100
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ701	Project Work – Phase II	EEC	0	0	8	4	60	40	100
	TOTAL CREDITS IN SEMESTER - VII		16						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

B.E - ROBOTICS AND AUTOMATION- EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
EMPLOYABILITY ENHANCEMENT COURSE									
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100
TOTAL CREDITS IN SEMESTER - VIII			08						

HS : Humanities and Social Sciences
BS : Basic Sciences
ES : Engineering Sciences
PC : Professional Core
PE : Professional Elective
GE : General Elective
OE : Open Elective
EEC : Employability Enhancement Courses
MC : Mandatory Courses
L : Lecture
T : Tutorial
P : Practical
C : Credit Point
CIA : Continuous Internal Assessment
ESE : End Semester Examination
TOT : Total

LIST OF HUMANITIES AND SOCIAL SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23HST101	Professional English - I	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு/Heritage of Tamils	HS	1	0	0	1	40	60	100
23HST201	Professional English - II	HS	3	0	0	3	40	60	100
23CYT201	Environmental Sciences and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
23HST701	Human Values and Ethics	HS	3	0	0	3	40	60	100

LIST OF BASIC SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MAT101	Matrices and calculus	BS	3	1	0	4	40	60	100
23PHE101	Engineering Physics	BS	3	0	2	4	50	50	100
23CYE101	Chemistry for Engineers	BS	3	0	2	4	50	50	100
23MAT201	Statistics and Numerical Methods with MATLAB	BS	3	1	0	4	40	60	100
23PHT201	Materials Science	BS	3	0	0	3	40	60	100
23MAT301	Transforms and Complex Functions	BS	3	1	0	4	40	60	100

LIST OF ENGINEERING SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GEE201	Engineering Graphics	ES	3	0	2	4	50	50	100
23GET201	Engineering Graphics	ES	3	1	0	4	40	60	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100

LIST OF PROFESSIONAL CORE

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEE202	Basic Electrical and Electronics Engineering	PC	3	0	2	4	50	50	100
23MET302	Engineering Mechanics	PC	3	1	0	4	40	60	100
23RMT301	Fundamentals of Robotics and Applications	PC	3	0	0	3	40	60	100
23RME301	Digital Electronics and Microprocessor	PC	3	0	2	4	50	50	100
23RME302	Electric Machines and Power System	PC	3	0	2	4	50	50	100
23RME303	Manufacturing Processes and Technology	PC	3	0	2	4	50	50	100
23RMT401	Embedded Systems and Programming	PC	3	0	0	3	40	60	100
23RMT402	Sensors and Actuators	PC	3	0	0	3	40	60	100
23RMT403	Kinematics and Dynamics of Robots	PC	3	0	0	3	40	60	100
23RME401	PLC and SCADA	PC	3	0	2	4	50	50	100
23MEE402	Strength of Materials	PC	3	0	2	4	50	60	100

LIST OF PROFESSIONAL ELECTIVE COURSES

Professional Elective - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP501	Robots and Systems in Smart Manufacturing	PE	3	0	0	3	40	60	100
23RMP502	Drone Technologies	PE	3	0	0	3	40	60	100
23RMP503	Microrobotics	PE	3	0	0	3	40	60	100
23RMP504	Agricultural Robotics and Automation	PE	3	0	0	3	40	60	100
23RMP505	Collaborative Robotics	PE	3	0	0	3	40	60	100
23RMP506	Robot Operating Systems	PE	3	0	0	3	40	60	100

Professional Elective - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP507	Robot and Machine Elements Design	PE	3	0	0	3	40	60	100
23RMP508	Lean Manufacturing	PE	3	0	0	3	40	60	100
23RMP509	Computer Integrated Manufacturing	PE	3	0	0	3	40	60	100
23RMP510	Electronics Manufacturing Technology	PE	3	0	0	3	40	60	100
23RMP511	Digital Manufacturing	PE	3	0	0	3	40	60	100
23RMP512	Computer Aided Inspection and Testing	PE	3	0	0	3	40	60	100

Professional Elective - III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP513	Electric and Hybrid Vehicles	PE	3	0	0	3	40	60	100
23RMP514	Embedded System Design	PE	3	0	0	3	40	60	100
23RMP515	Automotive System Modelling andSimulation	PE	3	0	0	3	40	60	100
23RMP516	Field and Service Robotics	PE	3	0	0	3	40	60	100
23RMP517	Automatic Control Systems	PE	3	0	0	3	40	60	100
23RMP518	Smart Mobility and Intelligent Vehicles	PE	3	0	0	3	40	60	100

Professional Elective - IV

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP601	Applied Signal Processing	PE	3	0	0	3	40	60	100
23RMP602	Machine Learning for Intelligent Systems	PE	3	0	0	3	40	60	100
23RMP603	Systems Modelling and Simulation Methods	PE	3	0	0	3	40	60	100
23RMP604	Optimization Techniques	PE	3	0	0	3	40	60	100
23RMP605	Maintenance and Safety Engineering Systems	PE	3	0	0	3	40	60	100
23RMP606	Micro Electro Mechanical Systems	PE	3	0	0	3	40	60	100

Professional Elective -V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP607	Robot Programming and Simulation	PE	3	0	0	3	40	60	100
23RMP608	Virtual Instrumentation	PE	3	0	0	3	40	60	100
23RMP609	Farm Automation	PE	3	0	0	3	40	60	100
23RMP610	Motion Control System	PE	3	0	0	3	40	60	100
23RMP611	Materials for Robotics	PE	3	0	0	3	40	60	100
23RMP612	Digital Twin and Industry5.0	PE	3	0	0	3	40	60	100

Professional Elective - VI

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23RMP613	Robotic Vision and Intelligence	PE	3	0	0	3	40	60	100
23RMP614	Wireless Sensors Networks for Robotics	PE	3	0	0	3	40	60	100
23RMP615	Integrated Product Development	PE	3	0	0	3	40	60	100
23RMP616	Navigation and Communication System	PE	3	0	0	3	40	60	100
23RMP617	Design of UAV systems	PE	3	0	0	3	40	60	100
23RMP618	Humanoid Robotics	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVE COURSES

OPEN ELECTIVES – I

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO607 / Environmental and Social Impact Assessment	OE	3	0	0	3	40	60	100
CSE	23CSO610 / Introduction to Drone Technologies	OE	3	0	0	3	40	60	100
ECE	23ECO602 / Fundamentals of Electronic Devices and Circuits	OE	3	0	0	3	40	60	100
EEE	23EEO603 / Electric Vehicle Technology	OE	3	0	0	3	40	60	100
	23EEO604 / Renewable Energy Systems	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO601 / Introduction to Industrial Engineering	OE	3	0	0	3	40	60	100
	23MEO605 / CNC Machining Technology	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO611 / Hospital Management	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO609 / Fundamentals of Robotics	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO612 / Cyber Forensics and Ethical Hacking	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO608 / Pharamaceutical Nanotechnology	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO606 / Graph Theory	OE	3	0	0	3	40	60	100

OPEN ELECTIVES- II

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO704 / Remote Sensing Concepts	OE	3	0	0	3	40	60	100
ECE	23ECO708 / Energy Technology	OE	3	0	0	3	40	60	100
EEE	23EEO709 / Sensors, Actuators and its Application	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO703 / Fundamentals of Mechatronics	OE	3	0	0	3	40	60	100
	23MEO704 / Nano Technology	OE	3	0	0	3	40	60	100
	23MEO712 / Smart Manufacturing	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO705 / Ultrasound Principles and its Medical Applications	OE	3	0	0	3	40	60	100
ROBOTICS AND AUTOMATION	23RAO707 / Mobile Robots	OE	3	0	0	3	40	60	100
CSE(Cyber Security)	23CSO711 / Introduction to Cyber Security	OE	3	0	0	3	40	60	100
PHARMACEUTICAL TECHNOLOGY	23PMO706 / Intellectual Property Rights for Pharma Industry	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO710 / Operations Research	OE	3	0	0	3	40	60	100

OPEN ELECTIVES – III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
CIVIL	23CEO717 / Geographical Information System	OE	3	0	0	3	40	60	100
CSE	23CSO715 / Fundamentals of Blockchain Technology	OE	3	0	0	3	40	60	100
ECE	23ECO718 / VLSI Design	OE	3	0	0	3	40	60	100
EEE	23EEO716 / Electrical, Electronic and Magnetic Materials	OE	3	0	0	3	40	60	100
MECHANICAL	23MEO720 / Marine Vehicles	OE	3	0	0	3	40	60	100
MEDICAL ELECTRONICS	23MDO719 / Wearable Technology	OE	3	0	0	3	40	60	100
	23MDO723 / Medical Waste Management								
	23MDO724 / Lifestyle Diseases								
ROBOTICS AND AUTOMATION	23RAO721 / Robotics Process Automation	OE	3	0	0	3	40	60	100
MATHEMATICS	23MAO714 / Advanced Numerical Methods	OE	3	0	0	3	40	60	100
MANAGEMENT	23MGO722 / Cost management of Engineering Projects	OE	3	0	0	3	40	60	100

GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23NCCL01	NCC AIRFORCE LEVEL-1	GE	3	0	0	3	40	60	100
23NCCL02	NCC AIRFORCE LEVEL - 2	GE	3	0	0	3	40	60	100
23NCCL03	NCC ARMY WING LEVEL-3	GE	3	0	0	3	40	60	100
23NCCL04	NCC ARMY WING LEVEL-4	GE	3	0	0	3	40	60	100

ELECTIVE – MANAGEMENT

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MGT701	Principles of Management	GE	3	0	0	3	40	60	100
23MGT702	Total Quality Management	GE	3	0	0	3	40	60	100
23MGT703	Engineering Economics and Financial Accounting	GE	3	0	0	3	40	60	100
23MGT704	Human Resource Management	GE	3	0	0	3	40	60	100
23MGT705	Knowledge Management	GE	3	0	0	3	40	60	100
23MGT706	Industrial Management	GE	3	0	0	3	40	60	100
23MGT707	Supply Chain Management	GE	3	0	0	3	40	60	100
23MGT708	e-Waste Management	GE	3	0	0	3	40	60	100

LIST OF EMPLOYABILITY ENHANCEMENT COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23EEC101	Soft Skills & Life Skills	EEC	1	0	0	1	100	-	100
23EEC201	Indian Language (Except Mother Tongue) / Foreign Language	EEC	0	0	4	2	100	-	100
23EEC301	Professional Development	EEC	0	0	2	1	100	-	100
23EEC401	Online Certification Courses	EEC	3	0	0	3	100	-	100
23EEC501	Industrial Training	EEC	0	0	4	2	100	-	100
23EEJ601	Project Work – Phase I	EEC	0	0	8	4	60	40	100
23EEJ701	Project Work – Phase II	EEC	0	0	8	4	60	40	100
23EEJ801	Product Development	EEC	0	0	12	6	60	40	100
23EEC801	Internship	EEC	0	0	4	2	100	-	100

LIST OF MANDATORY COURSES

MANDATORY COURSES - I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC501	Introduction to Women and Gender Studies	MC	3	0	0	0	-	-	-
23MDC502	Elements of Literature	MC	3	0	0	0	-	-	-
23MDC503	Film Appreciation	MC	3	0	0	0	-	-	-
23MDC504	Disaster Risk Reduction and Management	MC	3	0	0	0	-	-	-
23MDC505	Constitution of India	MC	3	0	0	0	-	-	-

MANDATORY COURSES - II

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
23MDC601	Well Being with Traditional Practices- Yoga, Ayurveda and Siddha	MC	3	0	0	0	-	-	-
23MDC602	History of Science and Technology in India	MC	3	0	0	0	-	-	-
23MDC603	Political and Economical Thought for a Human Society	MC	3	0	0	0	-	-	-
23MDC604	State, Nation Building and Politics in India	MC	3	0	0	0	-	-	-
23MDC605	Industrial Safety	MC	3	0	0	0	-	-	-

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NAAC Accredited with 'A' Grade
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU

ESTD 2001

ISO 9001 REGISTERED

SCHEME

CREDIT SUMMARY

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2023-2024 onwards)

CREDIT SUMMARY

DEPARTMENT OF ROBOTICS AND AUTOMATION

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	8	-	-	-	-	3	-	15
BS	16	7	4	-	-	-	-	-	23
ES	-	6	4	4	-	-	-	-	14
GE	-	-	-	-	-	-	3	-	3
PC	-	4	15	17	10	8	-	-	59
PE	-	-	-	-	9	9	-	-	18
OE	-	-	-	-	-	3	6	-	9
EEC	1	2	1	3	2	4	4	8	24
MC	-	-	-	-	-	-	-	-	-
Total	21	27	24	24	21	24	16	8	165

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ISO 9001 REGISTERED

SCHEME FOR SYLLABI

B.E. –RM (ROBOTICS AND AUTOMATION)

SEMESTER I

23HST101	**PROFESSIONAL ENGLISH**	L T P C
	(Common to all B.E. & B.Tech. Branches)	3 0 0 3

OBJECTIVES

- To build vocabulary proficiency and familiarity with varied lexical and contextual usages.
- To strengthen grammatical accuracy for effective sentence construction and language application.
- To develop clarity and coherence in written communication across academic and business contexts.
- To enhance oral fluency, confidence, and interactive communication skills.
- To promote efficient reading strategies for comprehension, analysis, and note-making.

UNIT I VOCABULARY 8

Synonyms and Antonyms - Word Formation - Sentence Types (declarative, imperative, interrogative & exclamatory) - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones - Collocation - British and American Vocabulary

UNIT II GRAMMAR 10

Parts of speech - Be, Have and Do verbs - Punctuation - Tenses - Numerical Adjectives - modal verbs - Single line Definition - Direct and Indirect Speech - Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

UNIT III WRITING 9

Letter Writing - Business communications - quotations, placing orders, complaints, replies to queries from business customers - Dialogue Writing – Paragraph Writing (descriptive, narrative, expository & persuasive) - Essay Writing - Writing Instructions.

UNIT IV SPEAKING 9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes - Tongue twisters

UNIT V READING SKILLS 9

Reading Comprehension – Reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short Comprehension Passages, practice skimming - Scanning and Predicting - Reading the passage and taking (Note making) Notes - Scan and understand main contents of the passage.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Use a wide range of vocabulary effectively in oral and written communication.
- Frame grammatically and meaningful sentences.
- Write formal and informal letters, develop coherent paragraphs and essays, and engage

in meaningful dialogues.

- Apply speaking skills for self-introduction, speeches, and technical presentations.
- Read, comprehend, and take organized notes from passages and technical content.

TEXT BOOKS

1. "Using English A Course book for Under graduate Engineers and Technologists", .Orient Black Swan Limited, Hyderabad, Board of Editors: 2015.
2. Richards, C. Jack ,"Interchange Students' Book-2",2015.

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", First Edition, Orient Black Swan, 2012.
2. Krishna Mohan, Meera Banerji, "Developing Communication Skills", Paperback, MacMillan, 2019.

E-RESOURCES

1. http://www.usingenglish.com
2. https://www.khanacademy.org/humanities/grammar

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	2	-	-
2	1	-	-	-	1	-	-	2	3	-	2	2	-	-
3	-	1	2	-	1	-	-	2	3	1	2	2	-	-
4	-	-	1	-	-	-	-	2	3	2	2	2	-	-
5	1	1	-	2	1	-	-	1	3	-	2	2	-	-
Avg.	1	1	1.5	2	1	-	-	1.8	3	1.5	2	2	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23MAT101 **MATRICES AND CALCULUS** L T P C
(Common to all B.E./ B.Tech. Branches) 3 1 0 4

OBJECTIVES

- To develop the use of matrix algebra and its properties.
- To explore the techniques of differential and integral calculus.
- To categorize methods for functions of several variables.
- To introduce the use of multiple integrals and their applications.
- To provide knowledge of vector calculus.

UNIT I MATRICES 9+3

Eigen values and Eigen vectors – Properties of Eigen values – Cayley-Hamilton theorem – Reduction of quadratic form to canonical form by orthogonal transformation – Nature of quadratic form.

UNIT II DIFFERENTIAL AND INTEGRAL CALCULUS 9+3

Differentiation rules: Derivatives of polynomials and exponential functions – The product and quotient Rules – Derivatives of trigonometric functions – The Chain rule – Implicit differentiation – Applications of differentiation: Maximum and Minimum Values – Techniques of integration: Integration by parts – Trigonometric integrals – Integration of rational functions by partial fractions.

UNIT III FUNCTIONS OF SEVERAL VARIABLES 9+3

Partial derivatives – Homogeneous functions – Euler's theorem – Total derivative – Jacobians –Taylor's theorem for functions of two variables – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS 9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double integrals.

UNIT V VECTOR CALCULUS 9+3

Scalar and vector point functions – Gradient – Divergence and curl – Line integral – Surface integral – Green's theorem in a plane – Volume integral – Divergence theorem – Irrotational and Solenoidal fields.

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply matrix algebra methods to solve practical problems.
- Apply the concepts of differential and integral calculus.
- Analyze the ideas of differential calculus for functions of several variables.
- Apply multiple integral ideas in solving areas and volumes.
- Solve the engineering problems using the concepts of vector calculus.

LIST OF TUTORIALS

1. Computation of Eigen values and Eigenvectors.
2. Matrix addition and multiplications.
3. Calculate differentiations of simple functions.
4. Calculate integrations of simple functions.
5. Determining Maxima and minima of functions for one variable.
6. Determining Maxima and minima of functions for two variables.
7. Evaluating double integral with constant limits.
8. Evaluating triple integral with constant limits.
9. Computing Gradient, divergence and curl of point functions.
10. Evaluating line integral in vector calculus.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, Forty Third Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, Seventh Edition, 2015.

REFERENCES

1. Bali N.P, Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), Seventh Edition, 2009.
2. Kanti B. Dutta., "Mathematical Methods of Science and Engineering – Aided with MATLAB", Cengage Learning, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/111105121 - (Differential Calculus and Integral Calculus)
2. https://nptel.ac.in/courses/111107112 - (matrix analysis)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	-	-	-	-	-	-	-	-	2	-	-
2	3	3	2	-	-	-	-	-	-	-	-	2	-	-
3	3	3	2	-	-	-	-	-	-	-	-	2	-	-
4	3	3	2	-	-	-	-	-	-	-	-	2	-	-
5	3	3	2	-	-	-	-	-	-	-	-	2	-	-
Avg.	3	3	2	-	-	-	-	-	-	-	-	2	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23HST102 **HERITAGE OF TAMILS** L T P C
1 0 0 1

OBJECTIVES

- To familiarize the students on extensive literature of classical Tamil.
- To analyze rock art paintings to modern art.
- To acquire knowledge on folk and martial arts.
- To apply the concepts of Thinai in Tamils.
- To realize the contribution of Tamils in Indian freedom struggle.

UNIT I LANGUAGEAND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils..

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, KaliyanKoothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL: 15 PERIODS

OUTCOMES

Upon the completion of the course, the students will be able to:

- Analyze the extensive literature Tamil and classical nature.
- Understand the heritage of sculpture, painting and musical instruments.
- Classify the folk and martial arts of Tamil people.
- Examine Thinai concepts, trade and victory of Chozha dynasty.
- Interpret the contribution of Tamils in Indian freedom struggle, Self-esteem movement and siddha medicine.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	2	1	2	-	1	-	-
2	-	-	-	-	-	-	-	2	1	2	-	1	-	-
3	-	-	-	-	-	-	-	2	1	2	-	1	-	-
4	-	-	-	-	-	-	-	2	1	2	-	1	-	-
5	-	-	-	-	-	-	-	2	1	2	-	1	-	-
Avg.	-	-	-	-	-	-	-	2	1	2	-	1	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23HST102 **தமிழர் மரபு** L T P C
1 0 0 1

நோக்கங்கள்

மாணவர்கள்கண்டிப்பாகஅறியவேண்டுவன:

- செம்மொழியானதமிழ்மொழியின்விரிவானஇலக்கியத்தைப்பற்றிஅறிதல்.
- பாறைஓவியங்கள்முதல்நவீனஓவியங்கள்வரைஉள்ளகலைகளைபகுப்பாய்வுசெய்தல்.
- நாட்டுப்புறக்கலைகள்மற்றும்வீரவிளையாட்டுகளைப்புரிந்துகொள்ளுதல்.
- தமிழர்களின்திணைக்கோட்பாடுகளைச்செயல்படுத்துதல்.
- இந்தியவிடுதலைப்போராட்டத்திற்கும்பண்பாட்டிற்கும்தமிழர்களின்பங்களிப்பைஉணருதல்.

UNIT I மொழி மற்றும் இலக்கியம் 3

இந்திய மொழி குடும்பங்கள்- திராவிட மொழிகள் -தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள்- சங்க இலக்கியத்தில் சமய சார்பற்ற தன்மை- சங்க இலக்கியத்தில் பகிர்தல் அறம்- திருக்குறளில் மேலாண்மை கருத்துக்கள் -தமிழ் காப்பியங்கள்- தமிழகத்தில் பௌத்த சமயங்களின் தாக்கம் -பக்தி இலக்கியம் ஆழ்வார்கள் மற்றும் நாயன்மார்கள்- சிற்றிலக்கியங்கள் -தமிழில் நவீன இலயக்யத்தின் வளர்ச்சி -தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு

UNIT II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை- சிற்பக்கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை -ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினை பொருட்கள் ,பொம்மைகள் -தேர் செய்யும் கலை-சுடுமண் சிற்பங்கள் -நாட்டுப்புற தெய்வங்கள்- குமரி முனையில் திருவள்ளுவர் சிலை-இசை கருவிகள் -மிருதங்கம் ,பறை ,வீணை,யாழ், நாதஸ்வரம் ,தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

UNIT III நாட்டுப்புற கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து,கரகாட்டம் ,வில்லுப்பாட்டு, கணியான் கூத்து ,ஒயிலாட்டம், தோல்பாவை கூத்து,சிலம்பாட்டம், வளரி ,புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

UNIT IV தமிழர்களின் திணைகோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும் , விலங்குகளும் -தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறகோட்பாடுகள்-தமிழர்கள் போற்றிய அறக்கோட்பாடு -சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவு,கல்வியும்- சங்க

கால நகரங்களும் துறை முகங்களும் -சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி -கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

UNIT V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்கு தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு- இந்தியாவின் பிறபகுதிகளில் தமிழ்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்தமருத்துவத்தின் பங்கு- கல்வெட்டுகள், கையெழுத்துப்படிகள் -தமிழ் புத்தகங்களின் வரலாறு

TOTAL: 15 PERIODS

முடிவுகள்

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- தமிழ்மொழியின் செம்மொழி தன்மையையும் சங்கஇலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்து கொள்வார்கள்.
- நாட்டுப்புறக் கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக்கோட்பாடுகளும் சங்ககாலவர்த்தகமும் புரிந்து கொள்வார்கள்.
- இந்திய விடுதலைப்போராட்டம், சுயமரியாதை இயக்கம், சித்தமருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

உரைமற்றும்குறிப்புபுத்தகங்கள்

1. தமிழகவரலாறு – மக்களும் பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகரநாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay)

(Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	2	1	2	-	1	-	-
2	-	-	-	-	-	-	-	2	1	2	-	1	-	-
3	-	-	-	-	-	-	-	2	1	2	-	1	-	-
4	-	-	-	-	-	-	-	2	1	2	-	1	-	-
5	-	-	-	-	-	-	-	2	1	2	-	1	-	-
Avg.	-	-	-	-	-	-	-	2	1	2	-	1	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23PHE101 **ENGINEERING PHYSICS** L T P C

(Common to Civil, Mechanical, R & A and Pharm. Tech) 3 0 2 4

OBJECTIVES

- To impart knowledge of the structure of crystalline materials using crystallographic techniques.
- To enable students to understand the concepts of elasticity, plasticity, stress, and strain and their significance in industrial applications.
- To introduce the fundamentals of ultrasonics and sound waves, along with their practical engineering applications.
- To explain complex physical phenomena through the principles of quantum mechanics and Schrödinger's wave equation.
- To provide an understanding of the modes of heat transmission, thermal conduction in solids, and their engineering applications.
- To determine the optical, mechanical, acoustic, thermal, and electrical properties of materials through laser, interferometric, bending, and thermal methods.

UNIT I CRYSTAL PHYSICS 9

Lattice and Unit cell – Crystal Systems and Bravais lattice – Lattice planes – Miller Indices – d -Spacing in Cubic lattice – Calculation of Number of Atoms per Unit Cell – Atomic radius ,Coordination Number, Packing factor for SC, BCC, FCC and HCP structures – Crystal Growth Techniques: Melt Growth Techniques (Bridgman and Czochralski).- Silicon chip Production Process.

UNIT II MECHANICAL PROPERTIES OF SOLIDS & FLUIDS 9

Elasticity – Stress-Strain Diagram and its Uses - Factors Affecting Elastic Modulus – Torsional Stress and Deformations – Twisting Couple - Torsion Pendulum: Theory and Experiment - Bending of beams - Bending Moment – Cantilever: Theory and Experiment – Non-Uniform Bending: Theory and Experiment - I-Shaped Girders.

UNIT III ACOUSTICS & ULTRASONICS 9

ACOUSTICS : Classification of Sound – Decibel - Weber Fechner Law- Reverberation-Sabine's formula (Concept only) - Factors affecting Acoustics of Buildings and their Remedies.

ULTRASONICS: Properties -Production of Ultrasonics - Magnetostriction and Piezoelectric methods - Non Destructive Testing – Pulse echo system, through Transmission and Reflection modes.

UNIT IV QUANTUM PHYSICS 9

Black Body Radiation – Planck's Theory (derivation) – Electron Diffraction – Wave function and its Physical significance – Schrödinger's Wave Equation: Time independent and time dependent equations - Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunneling & Scanning Tunneling Electron Microscope

UNIT V THERMAL PHYSICS 9

Transfer of Heat Energy – Thermal expansion of Solids and Liquids – Expansion joints - Bimetallic strips - Thermal Conduction, Convection and Radiation – Heat conductions in

Solids – Thermal Conductivity Lee's disc method: Theory and Experiment - Geothermal Energy - Geothermal power - Thermal battery - Thermal Energy Storage.

LIST OF EXPERIMENTS

(Any Eight experiments to be conducted)

1. Determination of wavelength of laser.
2. Determination of particle Size lycopodium powder using laser.
3. Determination of wavelength of mercury spectrum- Spectrometer.
4. Determination of Young's modulus - Uniform bending.
5. Torsional Pendulum: Determination of moment of inertia and rigidity modulus.
6. Determination of velocity of ultrasonic in liquid.
7. Determination of Viscosity of a liquid –Poiseulle's Method.
8. Determination of thermal conductivity of bad conductor using Lee's Disc Apparatus.
9. Determination of Specific resistance of a given wire using Carey's Foster's Bridge (Virtual).
10. Radiation with Temperature Change Using Stefan's Law. (Virtual)

TOTAL:45+15=60PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply crystallographic knowledge to get familiar with the structure of crystalline solids.
- Analyze the mechanical properties of solids and fluids.
- Explain the fundamentals of sound waves and ultrasonic's and their engineering applications.
- Analyze the principles of quantum mechanics and Schrödinger's wave equation to identify complex physical phenomena.
- Analyze the concept of thermal conductivity and its engineering applications.
- Evaluate fundamental properties of materials—such as wavelength, particle size, elastic constants, ultrasonic velocity, viscosity, thermal conductivity and electrical resistance.

TEXT BOOKS

1. P.Mani, "A Text book of Engineering Physics" Dhanam Publications, 2018.
2. Rajendran V. "Engineering Physics". TaTa McGraw Hill Publications, 2016
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics",McGraw Hill, 2017

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2010.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2009
3. K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019
4. D.Halliday, R.Resnick and J.Walker. "Principles of Physics", Wiley (Indian Edition), 2015

E-RESOURSES

1. https://archive.nptel.ac.in/courses/122/107/122107035/
2. https://archive.nptel.ac.in/courses/115/101/115101107/

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
2	3	3	1	1	-	-	-	-	-	-	-	-	-	-
3	3	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3	3	1	1	-	-	-	-	-	-	-	-	-	-
5	3	3	1	1	-	-	-	-	-	-	-	-	-	-
6	3	3	1	1	-	-	-	-	-	-	-	-	-	-
Avg.	3	3	1	1	-	-	-	-	-	-	-	-	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23CYE102	CHEMISTRY FOR ENGINEERS (Common to CIVIL, MECH, R&A)	L T P C 3 0 0 3

OBJECTIVES

- To apply water quality analysis and treatment methods for industrial applications.
- To explain the classification, properties, manufacture, and applications of fuels.
- To utilize spectroscopic and chromatographic techniques for chemical analysis.
- To familiarize students with the principles of energy conversion in nuclear reactors, solar cells, batteries, and fuel cells.
- To apply electrochemical principles to understand corrosion and corrosion control methods.
- To inculcate practical skills in the determination of water quality parameters and instrumental analysis

UNIT I WATER TECHNOLOGY 9

Introduction - Characteristics – Hardness – Estimation of hardness by EDTA method – Alkalinity and its estimation - Boiler feed water – Requirements –Boiler troubles (Scale and Sludge) – Internal conditioning (phosphate, calgon and carbonate conditioning methods) – External conditioning – Zeolite process, Demineralization process – Desalination of brackish water by reverse osmosis.

UNIT II FUELS AND COMBUSTION 9

Fuels: Introduction - Classification of fuels - Coal - Carbonization - Manufacture of metallurgical coke (Otto Hoffmann method) - Petroleum – Manufacture of synthetic petrol (Bergius process) - Knocking - Octane number - Diesel oil - Cetane number –Natural gas - Compressed Natural Gas (CNG) - Power Alcohol and Biodiesel. Combustion of fuels: Introduction - Calorific value - Higher and lower calorific values- Ignition temperature - Spontaneous ignition temperature – Explosive range - Flue gas analysis (ORSAT Method).

UNIT III ANALYTICAL CHEMISTRY 9

Spectroscopy: Electromagnetic spectrum-Absorption of radiation –Electronic, Vibrational and rotational transitions. UV-Visible and IR Spectroscopy-Principles, instrumentation (Block Diagram Only).- Chromatography - General principles - classification - Gas chromatography – High Pressure Liquid Chromatography –Applications.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear Fission – Controlled nuclear fission – Nuclear fusion – Differences between nuclear fission and fusion – Nuclear chain reactions – Nuclear energy – Light water nuclear power plant – Breeder reactor – Solar energy conversion – Solar cells - Wind energy. Batteries - Types of batteries –lead acid battery, lithium-ion-battery Fuel Cells - H 2 -O 2 fuel cell.

UNIT V ELECTROCHEMISTRY, CORROSION AND ITS CONTROL 9

Introduction- Electrochemical cells, applications of electrochemical series-Reference Electrode- standard calomel electrode, ion selective electrode, glass electrode, Corrosion – Types – Chemical Corrosion – Electrochemical Corrosion (galvanic and differential aeration) – Factors influencing corrosion – Material selection and design aspects-Control methods of corrosion –sacrificial anodic and impressed current cathodic protection.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by Argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Estimation of sodium and potassium present in water using flame photometer.
7. Conductometric Precipitation Titration using $BaCl_2$ and Na_2SO_4.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of Ferrous ions by Potentiometric Titration.
10. Estimation of copper content in the brass by Iodometry.

TOTAL: 45 + 15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to

- Explain the quality parameters of water and suitable methods for removing impurities in domestic and industrial applications.
- Interpret the characteristics of fuels and their role in efficient and eco-friendly combustion systems.
- Analyze the interaction of light with matter and the use of analytical techniques to characterize molecules.
- Explain the energy resources and their applications in the energy sector.
- Analyze the causes of corrosion and effective methods for its prevention and control.
- Determine the water quality parameters and perform quantitative chemical analysis by pH metery, flame photometry, conductometry and potentiometry

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company (P) Ltd., 2015.
2. R.Gopalan, "Analytical Chemistry" Sultan Chand & Sons, Third Edition, 2017.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company Ltd, 2015.
2. Shobha Ramakrishnan, Banani Mukhopadhyay, "Essentials of Analytical Chemistry" Pearson Education India, 2018.

E-RESOURCES

1. https://nptel.ac.in/courses/104105084 - (Analytical Chemistry)
2. http://library.iitbbs.ac.in/open-access-e-resources.php

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	3	-	1	-	-	3	-	-	-	-	-	-
2	2	2	3	2	1	2	2	2	2	2	1	2	-	-
3	3	3	3	3	3	2	2	2	2	2	2	3	-	-
4	2	2	2	3	3	2	2	2	1	1	1	-	-	-
5	3	2	3	2	3	2	2	1	2	1	-	2	-	-
6	3	3	2	1	1	2	2	1	1	2	-	-	-	-
Avg.	2.50	2.17	2.67	2.20	2.00	2.00	2.00	1.83	1.60	1.60	1.33	2.33	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23GEE101 **PROGRAMMING IN C** L T P C
(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To impart fundamental knowledge of C programming concepts, syntax, data types, operators, control structures, and program development.
- To develop students' understanding of arrays, strings, searching, and sorting techniques for solving computational problems.
- To train students in designing modular programs using functions, recursion, pointers, and parameter passing mechanisms.
- To familiarize students with structures, unions, dynamic memory allocation, and their applications in software development.
- To enable students to perform file handling operations and develop efficient C programs using sequential and random file processing.
- To develop C programs to solve real-world programming problems.

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Structure of C program – C programming: Data Types– variables–Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions –Input/Output statements, Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Compilation process.

Coding practices :

1. Develop a program to find the largest of three numbers using nested if statements.
2. Develop a program to generate multiplication tables using loops.

Problem - solving assignments :

1. Write a program to calculate the area and perimeter of a rectangle, circle, and triangle.
2. Write a program to calculate simple interest and compound interest.

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Example Program: Computing Mean, Median and Mode – Two dimensional arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) – String operations: length, compare, concatenate, copy –Sorting – Selection sort, Insertion sort, Merge sort, quick sort –Searching – linear and binary search.

Coding practices :

1. Develop a program to perform matrix addition and transpose using two-dimensional arrays.
2. Write a program to sort an array using Insertion Sort.

Problem - solving assignments :

1. Develop a program to perform matrix operations such as addition and transpose using two-dimensional arrays.
2. Write a program to search for an element in an array using Linear Search and Binary Search.

UNIT III FUNCTIONS AND POINTERS 9

Introduction to functions: Function prototype, function call, Built–in functions (string functions,

math functions) – Recursion – Example Program: Computation of Sine series, Scientific calculator using built-in functions – Pointers – Pointer operators – Arrays and pointers – Example Program: Sorting of names – Parameter passing: Pass by value, Pass by reference – Example Program: Swapping of two numbers and changing the value of a variable using pass by reference.

Coding practices :

1. Develop a recursive program to generate the Fibonacci series.
2. Develop a program to implement a scientific calculator using built-in mathematical functions.

Problem - solving assignments :

1. Write a program to perform arithmetic operations using user-defined functions.
2. Write a program to swap two numbers using pass-by-value and pass-by-reference.

UNIT IV STRUCTURES AND UNION 9

Structure – Example Programs – Nested structures – Pointer in Structures – Array of structures -

Example Program using structures and pointers – Self referential structures – Dynamic memory allocation.

Union- Storage classes

Coding practices :

1. Develop a program to generate an employee salary slip using structures and pointers.
2. Develop a program using nested structures to represent student academic details.

Problem - solving assignments :

1. Write a program to store and display employee details using an array of structures.
2. Develop a program to demonstrate dynamic memory allocation using structures.

UNIT V FILE PROCESSING 9

Files – Operations of File – Types of file processing: Sequential access, Random access – Sequential access file – Random access file – Command line arguments.

Coding practices :

1. Write a program to create, write, and read a text file.
2. Develop a program to copy the contents of one file to another.

Problem - solving assignments :

1. Write a program to create, write, and read student records using sequential file processing.
2. Write a program to implement command-line arguments for performing arithmetic operations or file processing.

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Programs using I/O statements, expressions and decision–making construct.
2. Write a program to find whether the given year is leap year or Not.
3. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
4. Check whether a given number is Armstrong number or not?
5. Given a set of numbers like <10, 36, 54, 89, 12, 27>, find sum of weights based on the following conditions.
   a) 5 if it is a perfect cube.

b) 4 if it is a multiple of 4 and divisible by 6.
c) 3 if it is a prime number.

6. Populate an array with height of persons and find how many persons are above the average height.
7. From a given paragraph perform the following using built–in functions:(i)Find the total number of words.(ii)Capitalize the first word of each sentence.(iii)Replace a given word with another word.
8. Solve towers of Hanoi using recursion.
9. Locate and Display the Contents of an Array using Pointers.
10. Generate salary slip of employees using structures and pointers.
11. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Explain the fundamental concepts of C programming and develop programs using data types, operators, expressions, and control structures.
- Develop C programs using arrays, strings, searching, and sorting techniques to solve computational problems.
- Construct modular C programs by applying functions, recursion, pointers, and parameter passing techniques.
- Develop applications using structures, unions, pointers, and dynamic memory allocation for efficient data organization and manipulation.
- Analyze file processing techniques using sequential and random access methods to perform data storage and retrieval operations.
- Develop reliable software solutions using C programming for real-world applications.

TEXT BOOKS

1. E.Balagurusamy,"Programming in ANSI C", Tata McGraw Hill, Eighth Edition, 2019.
2. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2016.

REFERENCES

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Juneja, B. L and Anita Seth, "Programming in C", CENGAGE Learning India pvt. Ltd., 2011.

E – RESOURCES

1. https://nptel.ac.in/courses/106/105/106105085/ - (Introduction to C Programming)
2. https://nptel.ac.in/courses/106/106/106106210/ - (Stack Operations)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	-	3	-	-	-	-	-	-	2	3	2
2	3	3	2	1	3	-	-	-	-	-	-	2	3	3
3	3	3	3	2	3	-	-	-	-	-	-	2	3	3
4	3	3	3	2	3	-	-	-	-	1	-	2	3	3
5	2	3	2	2	3	-	-	-	-	1	-	2	3	2
6	3	3	3	2	3	-	-	1	1	2	1	2	3	3
Avg.	2.83	2.83	2.5	1.8	3	-	-	1	1	1.33	1	2	3	2.66

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23EEC101 **SOFT SKILLS & LIFE SKILLS** L T P C

(Common to all First year / First Semester B.E., B.Tech., Branches) 1 0 0 1

OBJECTIVES

- To understand the Universal Human Values
- To have an overview on Life skills required in their profession
- To manage the behavior with emotional intelligent skills
- To learn professional Skills required for 21st century
- To formulate and implement effective leadership strategies.

UNIT I UNIVERSAL HUMAN VALUES 3

Understanding harmony in the human being - understanding harmony in the family and society - understanding harmony in the nature and existence - understanding of harmony on professional ethics

UNIT II LIFE SKILLS 3

Soft Skills – Positive Attitude - Empathy - Effective Communication - Decision-Making Skills - Communication Skills - Problem Solving - Critical Thinking- Analytical thinking

UNIT III EMOTIONAL SKILLS 3

Self-Awareness - Interpersonal Relationship - Stress – Stress management - Focus and Self Control - Positive Thinking – Anger management

UNIT IV PROFESSIONAL SKILLS 3

21st century skills – Hard Skills - General computer skills - Spreadsheet proficiency - Career Skills - developing a long - term career plan – Team Work -- Time management

UNIT V LEADERSHIP SKILLS 3

Leadership, Levels of Leadership, Making of a leader, Types of leadership, describing a leadership style.

TOTAL: 15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Treat and respect the human beings with harmony,
- Develop the capabilities needed to utilize their potential wherever required.
- Control their emotional feelings and manage the stress.
- Explore the career & professional skills.
- Become highly confident as a leader and find new ways of influencing the teams they lead.

TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015
3. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", First Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; First Edition; Wiley Publishing Ltd.

E-RESOURSES

1. https://uhv.org.in/
2. https://nptel.ac.in

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	-	-	-	2	2	2	3	2	1	-	-	-
2	1	3	1	1	-	1	1	-	2	3	3	1	-	-
3	-	1	-	-	-	1	1	-	3	3	3	1	-	-
4	2	2	1	1	3	1	1	-	2	3	3	3	-	-
5	1	1	1	-	-	2	2	-	3	3	3	3	-	-
Avg.	1.25	1.6	1	1	3	1.4	1.4	2	2.6	2.8	2.6	2	-	-

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23MDC101 INDUCTION PROGRAMME (2 Weeks)

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character."

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Physical Activity

This would involve a daily routine of physical activity with games and sports etc.

Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References: Guide to Induction program from AICTE

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SEMESTER II

23MAT201 **STATISTICS AND NUMERICAL METHODS** L T P C
(Common to Mechanical, R&A and PT) 3 1 0 4

OBJECTIVES

- To introduce basic concepts in testing of hypothesis.
- To explore the knowledge of classifications of design of experiments.
- To develop the concepts of solving algebraic, transcendental and system of linear equations.
- To introduce the numerical techniques of interpolation and integration.
- To explain various numerical methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3

Sampling distribution – Testing of significance for single proportion, single mean and difference of means – Test of significance for small samples by 't' test – Snedecor's F- test of significance – Chi-square test : Chi-square test of goodness of fit – Independent of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

Basic principles of experimental design – Completely randomised design – Analysis of variance for one way classification – Randomised block design – Analysis of variation for two factor experiments variations – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations by Newton Raphson method – Solution of simultaneous algebraic equations by Gauss elimination, Gauss Jordan and Gauss Seidel methods – Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9+3

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's interpolation formula – Newton's divided difference formula – Numerical integration by Trapezoidal and Simpson's 1/3 rule –Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Euler's method – Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations – Taylor's series method – Predictor-corrector methods: Milne's method – Adams-Bash forth method.

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply the concepts of hypothesis testing to analyze small and large sample data.
- Analyze the basic concepts of classifications of design of experiments.
- Compute the numerical solution of algebraic, transcendental and system of linear equations.
- Apply the numerical techniques of interpolation and integration.

- Evaluate the numerical solution of ordinary differential equations.

LIST OF TUTORIALS

1. Solving one sample and paired sample 't' Test.
2. Statistical Analysis Using Chi-Square Test.
3. One-Way ANOVA Table
4. Two-Way ANOVA Table
5. Solution of simultaneous algebraic equations by Gauss Seidel method.
6. Find the Eigen values of a matrix by Power method.
7. Illustrate Lagrange's interpolation formula.
8. Evaluation of line integral by Simpson's one-third rule.
9. Solving ordinary differential equations by Euler's method.
10. Solving ordinary differential equations by Runge-Kutta method.

TOTAL: 45+15 PERIODS

TEXT BOOKS

1. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Tenth Edition, 2015.
2. Dr.Kandasamy. P, Dr.Thilagavathy . K and Dr. Gunavathy .K., "Statistics and Numerical Methods", S. Chand and Company Ltd., 2010.

REFERENCES

1. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Nineth Edition, 2016.
2. Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Twelveth Edition, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105041/ - (Statistics)
2. https://nptel.ac.in/courses/111/107/111107105/ - (Numerical Methods)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	-	1	-	-
2	3	3	2	2	2	-	-	-	-	-	-	1	-	-
3	3	3	2	2	2	-	-	-	-	-	-	1	-	-
4	3	3	2	2	2	-	-	-	-	-	-	1	-	-
5	3	3	2	2	2	-	-	-	-	-	-	1	-	-
6	3	3	2	2	2	-	-	-	-	-	-	1	-	-
Avg.	3	3	2	2	2	-	-	-	-	-	-	1	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23PHT201 **ADVANCED PHYSICS OF MATERIALS** L T P C
(Common to Civil, Mechanical, R & A and Pharm.Tech) 3 0 0 3

OBJECTIVES

- To learn the principles of cryogenics and superconductivity and applications.
- To know the application of physics concepts to microscopic and NDT Testing.
- To understand different kind of nano materials and synthesis of nano materials, applications.
- To acquire the knowledge of advanced and smart materials for various engineering applications.
- To study different composite materials and synthesize methods.

UNIT I CRYOGENICS 9

Introduction to Cryogenics - Properties of Cryogenic Fluids- Gas-Liquefaction of Gases and Refrigeration Systems – Cryocoolers -Cryogenic Insulations - Superconductivity: Properties – Type I and Type II Superconductors – BCS theory of Superconductivity - High tc superconductors – General applications of Superconductors.

UNIT II MATERIALS CHARACTERIZATION 9

Introduction to materials and Techniques-X-Ray Diffraction (XRD) – Atomic Force Microscopy (AFM)- Fourier Transform Infrared Spectroscopy (FTIR)- UV-Vis Spectroscopy- Non-Destructive Testing (NDT) : Liquid Penetrant Test, Magnetic Detection, Electromagnetic Testing, Ultrasonic Test.

UNIT III NANOMATERIALS & NANODEVICES 9

Emergence of Nano science - Role of Particle Size - Quantum Structures: Quantum Well, Quantum Wire and Quantum Dot- Properties at Nano Scale (Optical, Electronic and Magnetic) - Synthesis of Nanomaterials: Physical Vapour Deposition (PVD) - Pulsed Laser Deposition (PLD) - Carbon Nanotubes: Types, Properties and applications - Micro Electro Mechanical Systems (MEMS)

UNIT IV SMART MATERIALS 9

Smart materials – Functional materials – Polyfunctional Materials – Structural Materials, Electrical Materials, Bio-Compatible Materials - Metallic Glasses: Types, Glass forming ability of Alloys, Melt spinning process, Applications - Shape Memory Alloys: Phases, Shape Memory Effect, Pseudo elastic effect, NiTi alloy, and applications.

UNIT V COMPOSITE MATERIALS 9

Definitions, Composites, Reinforcements and Matrices, Types of Reinforcements, Types of Matrices, Types of Composites, Carbon Fibre Composites, Properties of Composites in Comparison with Standard Materials, Applications of Metal, Ceramic and Polymer matrix composites.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to;

- Analyze the potential applications of superconductors.
- Develop knowledge on various materials characterization techniques.

- Discuss the fundamentals of nano materials and various synthesize methods.
- Develop knowledge about smart materials and their applications.
- Design methodologies and develop the principles of composite materials.

TEXT BOOKS

1. P.Mani, "A Text book of Engineering Physics" Dhanam Publications, 2018
2. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2017.
3. Sam Zhang, Lin Ki, Ashok Kumar, "Materials Characterization Techniques", CRC Press, Taylor & Francis Group, 2019.

REFERENCES

1. Askeland, D. "Materials Science and Engineering". Brooks/Cole, 2015.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2017.
3. P.Santhana Ragavan and P. Ramasamy, "Crystal Growth Processes and Methods", KRU Publications, 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/112108150/
2. https://swayam.gov.in/nd1_noc19_mm13/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	2	1	2	1	1	-	-	-	-	-	-	-
2	2	3	2	1	2	1	1	-	-	-	-	-	-	-
3	2	3	2	1	2	1	1	-	-	-	-	-	-	-
4	2	3	2	1	1	1	1	-	-	-	-	-	-	-
5	2	3	2	1	2	1	1	-	-	-	-	-	-	-
Avg.	2	3	2	1	1.8	1	1	-	-	-	-	-	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23CYT201 **ENVIRONMENTAL SCIENCE AND SUSTAINABILITY** L T P C
(Common to All B.E /B.Tech Branches) 3 0 0 3

OBJECTIVES

- To familiarize students with the concepts of environment, ecosystems, biodiversity, and their conservation.
- To create awareness about environmental pollution, individual responsibilities in pollution prevention, and basic disaster management.
- To impart knowledge about major social and environmental issues, environmental protection laws, and green chemistry principles.
- To analyze population-related issues, human health, social welfare, and the role of information technology in environmental and human health.
- To develop an understanding of sustainability concepts, climate change issues, and sustainable management practices for addressing environmental challenges.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – Need for public awareness - Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) aquatic ecosystems (oceans) – Introduction to biodiversity definition: genetic, species and ecosystem diversity –Value of biodiversity – Threats to biodiversity – Endangered and endemic species of India – Conservation of biodiversity: In-Situ and Ex-Situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution – Solid waste management: causes, effects and control measures of municipal solid wastes - E-waste – Role of an individual in prevention of pollution - Pollution case studies – Disaster management: floods, earthquake and cyclone.

Activity: Local pollution case study and report submission.

UNIT III SOCIAL ISSUES AND THE ENVIRONMENT 9

Water conservation, rain water harvesting, watershed management – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – Green Chemistry and principles - Environment production act – Air (Prevention and Control of Pollution) act –Water (Prevention and control of Pollution) act

Activity: Creating environmental awareness.

UNIT IV HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of information technology in environment and human health – Case studies.

Activity: Visit to local primary health center.

UNIT V SUSTAINABLE MANAGEMENT 9

Sustainability-Concept, needs and challenges-economic, social and aspects of sustainability- From unsustainability to sustainability- -Sustainable Development Goals-Targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-Case studies. Zero waste, Material Life cycle assessment, Sustainable habitat: Energy efficiency, Sustainable transports.

Activity: Field trips to local organizations or facilities with sustainable practices in place.

OUTCOMES **TOTAL: 45 PERIODS**

Upon completion of the course, Students will be able to

- Explain the basics of environment, ecosystems, biodiversity, and conservation.
- Identify major sources of pollution and understand individual responsibilities in pollution prevention and disaster management.
- Describe key social and environmental issues, environmental laws, and green chemistry principles.
- Analyse population growth, human health, social welfare, and the role of IT in environmental and health management.
- Apply sustainability concepts, climate change mitigation, and sustainable management practices to environmental challenges.

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, 2019.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education, Eighth Edition, 2021.
3. Allen, D. T. and Shonnard, D. R., "Sustainability Engineering: Concepts, Design and Case Studies", Prentice Hall, Third Edition, 2018.

REFERENCES

1. Erach Bharucha, "Textbook of Environmental Studies", Universities Press (I) Pvt Ltd, 2016.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, 2018.
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/
2. https://swayam.gov.in/nd1_noc19_ge22/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	3	-	-	3	3	3	-	-	2	1	-	-
2	2	2	3	2	3	3	3	3	-	-	3	3	-	-
3	2	1	3	2	2	3	3	3	-	2	3	3	-	-
4	2	1	3	2	3	3	3	3	2	3	2	2	-	-
5	2	1	3	2	3	3	3	3	2	3	2	2	-	-
Avg.	2	1.4	3	2	2.8	3	3	3	2	2.7	2.4	2.2	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23HST202 **TAMILS AND TECHNOLOGY** **L T P C**
1 0 0 1

OBJECTIVES

- To gain knowledge about weaving and ceramic Technology
- To create a design and construction Technology
- To analyze manufacturing Technology
- To apply agriculture and irrigation Technology
- To remember scientific and scientific Tamil and Tamil computing

UNIT I WEAVING AND CERAMIC TECHNOLOGY **3**

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY **3**

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY **3**

Dam, Tank, ponds, Sluice, Significance of KumizhiThoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing Knowledge of Sea - Fisheries– Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING **3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

OUTCOMES

Upon the completion of the course, the students will be able to:

- Understand weaving under ceramic Technology.
- Develop new design and construction Technology.
- Identify the manufacturing Technology.
- Understand agriculture and irrigation.
- Knowledge of scientific Tamil and Tamil computing.

TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	2	1	-	-	1	-	-
2	-	-	-	-	-	-	-	2	1	-	-	1	-	-
3	-	-	-	-	-	-	-	2	1	-	-	1	-	-
4	-	-	-	-	-	-	-	2	1	-	-	1	-	-
5	-	-	-	-	-	-	-	2	1	-	-	1	-	-
Avg.	-	-	-	-	-	-	-	2	1	-	-	1	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23HST202 **தமிழரும் தொழில்நுட்பமும்** L T P C

(அனைத்து துறைகளுக்கும் பொதுவானது) 1 0 0 1

நோக்கம்

மாணவர்கள்கண்டிப்பாகஅறியவேண்டுவன:

- நெசவுமற்றும்பீங்கான்தொழில்நுட்பம்பற்றியஅறிவைப்பெறுதல்.
- வடிவமைப்புமற்றும்கட்டுமானதொழில்நுட்பத்தைஉருவாக்குதல்.
- உற்பத்திதொழில்நுட்பத்தைப்பகுப்பாய்வுசெய்தல்.
- விவசாயம்மற்றும்நீர்ப்பாசனத்தொழில்நுட்பத்தைப்பயன்படுத்துதல்.
- அறிவியல்மற்றும்அறிவியல்தமிழ்மற்றும்தமிழ்கணிப்பொறிதொடர்பானஅறிவைநினைவில்கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பாணைதொழில்நுட்பம் 3

சங்ககாலத்தில் நெசவுத்தொழில் – பாணை தொழில்நுட்பம் - கருப்பு, சிவப்பு பாண்டங்கள் – பாண்டுகளில் கீறல் குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத்தொழில்நுட்பம் 3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்ககாலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடைஅமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச்சிற்பங்கள், கோவில்களும் – சோழர்காலத்தூபெருங்கோயில்கள் மற்றும் பிறவழிபாட்டுத்தலங்கள் நாயக்கர்கால கோயில்கள் – மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக்கட்டிடக்கலை.

அலகு 3 உற்பத்தித்தொழில்நுட்பம 3

கப்பல் கட்டும் கலை - உலோகவியல் – இரும்பு தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச்சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் – நாணயங்கள் அச்சடிகள் – மணிஉருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண்மணிகள் - சங்குமணிகள் - எலும்புதுண்டுகள் - தொல்லியல்சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனதொழில்நுட்பம் 3

அணை, குளங்கள், மடகு – சோழர்காலகுமுளிதூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு - மீன்வளம் – முத்து மற்றும் முத்து குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணித்தமிழ் வளர்ச்சி – தமிழ்நூல்களை மின்பதிப்பு செய்தல் – தமிழ்மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக்கல்விக்கழகம் - தமிழின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத்திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்

- பாடத்தின்முடிவில், மாணவர்கள்அறிந்துகொள்வன:
- பீங்கான்மற்றும்நெசவுதொழில்நுட்பத்தைப்புரிந்துகொள்ளுதல்.
- புதியவடிவமைப்புமற்றும்கட்டுமானதொழில்நுட்பத்தைஉருவாக்குதல்.
- உற்பத்தித்தொழில்நுட்பத்தைஅடையாளம்காணுதல்.
- விவசாயம்மற்றும்நீர்ப்பாசனத்தைப்புரிந்துகொள்ளுதல்.
- அறிவியல்தமிழ்மற்றும்தமிழ்கணிப்பொறிதொடர்பானஅறிவைபெறுதல்.

உரைமற்றும்குறிப்புபுத்தகங்கள்

1. தமிழகவரலாறு - மக்களும்பண்பாடும் – கே. கே. பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை –ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi – 'Sangam City Civilization on the banks of the river Vaigai' (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
10. Studies in the History of India with Special Reference to Tamilnadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamilnadu Textbook and Educational Services Corporation, Tamilnadu.)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	2	1	-	-	1	-	-
2	-	-	-	-	-	-	-	2	1	-	-	1	-	-
3	-	-	-	-	-	-	-	2	1	-	-	1	-	-
4	-	-	-	-	-	-	-	2	1	-	-	1	-	-
5	-	-	-	-	-	-	-	2	1	-	-	1	-	-
Avg.	-	-	-	-	-	-	-	2	1	-	-	1	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23GET201 **ENGINEERING GRAPHICS** **L T P C**

(Common to Mech, Civil and Robotics Department) **3 1 0 4**

OBJECTIVES

- To introduce the fundamental principles of engineering graphics, drawing instruments, and construction of plane curves.
- To teach methods for projecting points, lines, and plane surfaces, including determination of true lengths and inclinations.
- To explain projection techniques of simple solids and handling axes inclined to reference planes using change of position method.
- To train learners in sectioning of solids and development of lateral surfaces of regular and truncated solids.
- To present conversion between orthographic and isometric projections and their practical applications in engineering drawing.

UNIT I PLANE CURVES **9+3**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per BIS conventions. **(Not for Examination)** Construction of ellipse – Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the curves.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **9+3**

Projection of points – Projection of straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to one reference planes.

UNIT III PROJECTION OF SOLIDS **9+3**

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SIMPLE SOLIDS AND DEVELOPMENT OF SURFACES **9+3**

Sectioning of simple solids like prisms and cone - Inclined to one reference plane. Development of lateral surfaces of simple and truncated solids: pyramids and cylinders.

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS **9+3**

Conversion of isometric projection into orthographic projection, Conversion of orthographic projection into isometric projection.

TOTAL : 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Construct multiple views of engineering components.
- Construct the pictorial drawings as per the standards.
- Develop the projection of solids.
- Draw the section of solids drawings and development of surfaces of given objects.
- Apply free hand sketching and concept of isometric in engineering practice.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, Fourth Edition, 2019.
2. Natarajan K.V., "Engineering Graphics", Dhanalakshmi Publishers, Thirty Second Edition, 2019.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", Subhas Publications, Thirteenth Edition, 2021.
2. T.Jeyapoovan. "Engineering Graphics using Auto CAD" Vikas publishing house Pvt Ltd, Sixth Edition, 2022 .

E- RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	-	3	1	-	-	-	-	-	2	2	-
2	3	2	2	-	3	1	-	-	-	-	-	2	2	-
3	3	2	2	-	3	1	-	-	-	-	-	2	2	-
4	3	2	2	-	3	1	-	-	-	-	-	2	2	-
5	3	2	2	-	3	1	-	-	-	-	-	2	2	-
Avg.	3	2	2	-	3	1	-	-	-	-	-	2	2	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23HSE201 **ENGLISH FOR ENGINEERS: THEORY AND PRACTICE** L T P C
(Common to all B.E. & B.Tech. Branches) 3 0 2 4

OBJECTIVES

- To strengthen grammatical accuracy for effective communication.
- To develop listening and reading comprehension skills.
- To improve writing proficiency for academic and formal purposes.
- To train in business and professional correspondence.
- To enhance speaking abilities for social and professional contexts.
- To provide practical exposure through interactive language activities.

UNIT I GRAMMAR 9

Articles - Prepositions - Conditionals - Subject verb agreement - Error Spotting - Active and Passive voice.

UNIT II LISTENING & READING 9

Syllabification – Improving Vocabulary - Reading Newspapers - Listening to Youtube Documentaries - Listening to Podcast - Listening to Motivational Movies.

UNIT III WRITING 9

Checklist - Recommendations - Formal letters – inviting guests – acceptance/declining letters

UNIT IV BUSINESS WRITING 9

E-mail writing - fixing an appointment, cancelling appointment, paper submission for seminars and conferences - Job Application Letter and Résumé.

UNIT V SPEAKING 9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Suggesting - Comparing and Contrasting - Situational Role-play.

TOTAL: 45 PERIODS

LIST OF EXERCISES

1. Stage Dynamics (Body Language and Paralanguage - Presentation)
2. Day today real time speaking exposures - Story narration, simple, general topics and incidents.
3. Group Discussion
4. Power Point Presentation (Corporate Skills & Public Speaking)
5. Loud Reading
6. Picture Description
7. Interview Skills (Mock Interview & Interview Etiquette)
8. Case Study Report

TOTAL: 15 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Use correct grammar in speech and writing.
- Understand and interpret information from various audio and reading sources.
- Write clear, structured, and formal documents.
- Prepare professional emails, résumés, and job-related letters.
- Communicate effectively in group discussions and presentations.
- Apply communication skills confidently in real-time situations.

TEXT BOOKS

1. S. Sumant, "Technical English" Maven Learning Private Limited,
2. Joshi, Manmohan, Soft Skills, Bookboon, First Edition, 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists", Cambridge University Press, First Edition, 2013.
2. Seely, John "Oxford Guide to Effective Writing and Speaking", Indian ed., New Delhi, Oxford University Press, 2005.

E-RESOURCES

1. https://www.fluentu.com/Blog/english/english-small-talk
2. https://www.britishcouncil.org

EXTENSIVE READING

1. Stephen R. Covey, "The 7 Habits of Highly Effective People", Simon & Schuster, 2019.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	-	-	-	1	-	-	-	2	3	-	2	-	-
2	1	2	-	2	-	-	-	-	-	3	-	1	-	-
3	1	-	-	-	-	-	-	1	-	3	2	2	-	-
4	-	-	-	-	1	-	-	2	-	3	2	2	-	-
5	-	-	-	-	-	-	-	1	3	3	2	1	-	-
6	-	-	-	-	-	2	2	2	2	3	-	2	-	-
Avg.	1	2	-	2	1	2	2	1.5	2.33	3	2	1.66	-	-

1- Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23EEE202 **BASIC ELECTRICAL AND ELECTRONICS ENGINEERING** L T P C
(Lab Embedded Theory Course) 3 0 2 4
(Common to AIDS, CSE, CSE-CS, IT, Robotics, PT)

OBJECTIVES

- To understand electric circuit laws, single and three phase circuits, wiring and measuring instruments.
- To gain knowledge of working principles of electrical machines.
- To learn the working principle of various electronic devices and applications.
- To understand the principles of digital electronics in digital world.
- To study the use of various measuring instruments.
- To provide practical knowledge on electrical and electronics engineering.

UNIT I ELECTRICAL CIRCUITS 9

DC circuits: Circuit components: Conductor, Resistor, Inductor, Capacitor - Ohm's Law - Kirchhoff's Laws - Independent and Dependent sources - Mesh analysis, Nodal analysis with Independent sources only (Steady state) – Thevenin's theorem – Maximum Power Transfer theorem.

Introduction to AC circuits and parameters: Waveforms, Average value, RMS value, Instantaneous power, real power, reactive power and apparent power, power factor - Steady state analysis of RL, RC & RLC circuits.

UNIT II ELECTRICAL MACHINES 9

DC Generators: Construction and working principle, EMF equation, Types and applications – DC Motors: Working principle, Types and applications - Construction, Working principle and applications: Single phase transformer, Three phase induction motor, BLDC, Stepper Motor.

UNIT III ANALOG ELECTRONICS 9

PN junction diodes and its applications - Zener diode: structure, operation, Zener diode as regulator –Construction, Working Principle and Characteristics: BJT, JFET, SCR, MOSFET.

UNIT IV DIGITAL ELECTRONICS 9

Review of number systems, binary codes, Combinational logic - Representation of logic functions - SOP and POS forms - Minimization using K maps for SOP - Half adder, Full adder – Multiplexer, Demultiplexer.

UNIT V MEASUREMENTS AND INSTRUMENTATION 9

Operating principle and Types of Moving coil and Moving iron meters - Measurement of power and Energy meter - Data acquisition.

LIST OF EXPERIMENTS

1. Verification of KVL & KCL.
2. Load test on DC shunt motor.
3. Characteristics of PN and zener diodes
4. Characteristics of BJT in CE Configuration.
5. Half wave and full wave rectifiers

6. Verifications of Half adder and Full adder.
7. Measurement of Single Phase Power.

TOTAL : 45+15 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Analyze electric circuits and choose appropriate instruments for electrical measurement for a specific application.
- Examine the concept of different types of DC and AC machines.
- Develop the diode's usage as a rectifier, and Zener diode's usage as an voltage regulator and discuss the basic characteristics of BJT.
- Design Boolean algebra to implement the combinational logic circuits.
- Analyze the operating principles of measuring instruments and choose suitable instrument for measuring the parameters.
- To Demonstrate and analyse practical electrical and electronics engineering.

TEXT BOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, Second Edition, 2020.
2. S. K. Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.

REFERENCES

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", McGraw Hill Education, Fourth Edition, 2019.
2. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/108108076 - (Basics of Electrical Technology).
2. https://www.digimat.in/nptel/courses/video/108105112/L01.html - (Fundamentals of Electrical Engineering).

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	-	-	-	1	-	-	-	1	3	-
2	3	1	-	1	-	-	-	1	-	-	-	1	3	-
3	3	-	-	1	-	-	-	1	-	-	-	1	3	-
4	3	3	2	1	-	-	-	1	-	-	-	1	3	-
5	3	-	-	-	-	-	-	1	-	-	-	1	3	-
6	3	3	2	-	-	-	-	1	3	3	-	1	3	3
AVG	3	2.5	2	1	-	-	-	1	3	3	-	1	3	3

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23GEL201 **ENGINEERING PRACTICES LABORATORY** **L T P C**
0 0 4 2

OBJECTIVES

The main learning objective of this course is to provide hands on training to the students in:

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP - A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used inhouse hold appliances.

WOOD WORK:

a) Sawing,
b) Planning and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

WOOD WORK STUDY:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac / Triac / quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP - B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK

a) (simple)Turning.
b) (simple) Drilling.
c) (simple) Tapping.

ASSEMBLY WORK

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

SHEET METAL WORK

a) Making of a square tray

FOUNDRY WORK

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY

a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

- Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
- Wire various electrical joints in common household electrical wire work.
- Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
- Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

Mapping of COs-POS & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	1	1	1	-	-	-	-	2	-	2
2	3	2	-	-	1	1	1	-	-	-	-	2	-	2
3	3	2	-	-	1	1	1	-	-	-	-	2	-	2
4	3	2	-	-	1	1	1	-	-	-	-	2	-	2
Avg.	3	2	-	-	1	1	1	-	-	-	-	2	-	2

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23EEC201 **INDIAN LANGUAGE (EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE** L T P C 0 0 4 2

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the Hindi alphabet, pronunciation, and basic writing.
- To understand and use basic Hindi grammar correctly.
- To develop basic reading, writing, listening, and speaking skills in Hindi.
- To use Hindi for simple everyday communication.
- To prepare learners to successfully clear the Hindi Examination.

UNIT I वर्णमालाएवंमूलभूतव्याकरण (ALPHABET AND BASIC GRAMMAR) 5

Hindi Vowels (स्वर)- Hindi Consonants (व्यंजन) -Matras (मात्राएँ)- Barakhadi (बारहखड़ी)-Word Formation (शब्दनिर्माण)- Gender (लिंग)- Number (वचन)- Basic Sentence -Formation (सरलवाक्यरचना)

UNIT II शब्दभंडारएवंव्याकरण (VOCABULARY AND GRAMMAR) 7

Nouns (संज्ञा)- Pronouns (सर्वनाम) -Adjectives (विशेषण) -Verbs (क्रिया) -Tenses (काल– Present, Past, Future) - Opposite Words (विलोमशब्द) -Synonyms (पर्यायवाची) -One-word Substitutions (अनेकशब्दोंकेलिएएकशब्द)

UNIT III पठनएवंलेखनकौशल (READING AND WRITING SKILLS) 7

Reading Simple Hindi Passages -Comprehension (गद्यांश) -Paragraph Writing (अनुच्छेदलेखन)- Letter Writing (पत्रलेखन)- Dialogue Writing (संवादलेखन) -Picture Description (चित्रवर्णन) -Dictation Practice (श्रुतिलेख)

UNIT IV दैनिकजीवनमेंहिंदी (HINDI FOR EVERYDAY COMMUNICATION) 7

Greetings and Introductions -Family Members (परिवार)- Days, Months, Seasons -Numbers (१–१००) -Time and Date - Colours, Fruits, Vegetables - Shopping Conversations - School and Classroom Vocabulary -Common Everyday Conversations

UNIT V साहित्यएवंपुनरावृत्ति (LITERATURE AND REVISION) 4

Simple Poems (कविताएँ)- Short Stories (लघुकथाएँ)- Proverbs and Idioms (मुहावरेएवंलोकोक्तियाँ– basic) -Moral Stories - Translation (English/Tamil to Hindi – Simple Sentences) - Revision of Grammar - Model Question Papers and Practice Tests

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

1. Write basic Hindi words and sentences.
2. Apply fundamental Hindi grammar in simple communication.
3. Develop basic reading, writing, listening, and speaking skills in Hindi.
4. Use Hindi confidently in day-to-day conversations.
5. Develop proficiency required to successfully clear the Hindi Examination.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	-	-	3	-	1	-	-
2	-	-	-	-	-	-	-	1	1	3	-	1	-	-
3	-	-	-	-	-	-	-	1	2	3	-	2	-	-
4	-	-	-	-	-	1	1	2	2	3	-	1	-	-
5	-	-	-	-	-	-	-	-	-	2	-	3	-	-
Avg.	-	-	-	-	-	1.0	1.0	1.3	1.6	2.8	-	1.6	-	-

1- Low 2 - Medium 3 - High '-' – No Correlation

P. Chairman - BoS

23EEC201 **INDIAN LANGUAGE** L T P C
(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE 0 0 4 2
(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the German alphabet, pronunciation, and basic communication.
- To understand and use basic German grammar and vocabulary.
- To communicate in German in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in German.
- To apply basic German language skills confidently through practice and revision.

UNIT I INTRODUCTION TO GERMAN LANGUAGE 6

German alphabet and pronunciation –Greetings -Self-introduction (Name, age, nationality, profession) - Numbers (0–100) -Days, months, seasons, and dates - Basic classroom expressions - Personal pronouns -Verb **sein** (to be) -Simple sentence formation

UNIT II BASIC GRAMMAR AND VOCABULARY 7

Definite and indefinite articles (der, die, das; ein, eine) - Nouns and gender - Singular and plural forms - Verb conjugation (regular verbs) - Present tense - Question words (Wer, Was, Wo, Wann, Wie, Warum) - Negation (nicht, kein) - Vocabulary: Family, occupations, countries, languages, colors

UNITIII EVERYDAY COMMUNICATION 7

Daily routine - Time and clock reading - Food and beverages - Shopping conversations - Asking for and giving directions -Making simple requests -Modal verbs (möchten, können) -Vocabulary: Home, school, transportation, weather

UNIT IV READING, WRITING, LISTENING, AND SPEAKING SKILLS 5

Reading short dialogues - Listening to simple conversations - Writing short paragraphs- Describing people, places, and objects - Introducing family and friends

UNIT V PRACTICAL APPLICATIONS AND REVISION 5

Travel and tourism vocabulary - At the restaurant - At the railway station and airport - Revision of grammar topics - Translation of simple sentences (English to German and German to English)

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Identify the German alphabet and pronounce basic German words correctly.
- Use basic German vocabulary and simple grammar in sentences.
- Practice in simple German for everyday situations.
- understand basic German texts and conversations.
- Apply basic German language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
2	-	-	-	-	-	-	1	1	3	-	1	1	-	-
3	-	-	-	-	-	1	2	2	3	-	2	2	-	-
4	-	-	-	-	-	-	1	2	3	-	2	2	-	-
5	-	-	-	-	-	1	2	2	3	-	2	2	-	-
Avg.	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	1.6	-	-

1- Low 2 - Medium 3 - High '-' – No Correlation

P. Kavitha
Chairman - BoS

23EEC201	INDIAN LANGUAGE	L T P C
	(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE	0 0 4 2

(Common to all B.E. & B.Tech. Branches)

OBJECTIVES

- To learn the Japanese writing system, pronunciation, and basic vocabulary.
- To understand and use basic Japanese grammar and sentence patterns.
- To communicate in Japanese in simple everyday situations.
- To develop basic reading, writing, listening, and speaking skills in Japanese.
- To apply basic Japanese language skills confidently through practice and real-life communication.

UNIT I WRITING SYSTEMS & PRONUNCIATION 5

Hiragana chart reading and writing - Katakana chart reading and writing - Basic pronunciation rules (long vowels, double consonants) – Numbers - Colours, body parts, pets description

UNIT II KANJI& BASIC GRAMMAR 7

First 50 Kanji (Numbers, Time & Days, Basic Directions & People) - Topic marker は (wa) - Identification sentences: Noun + です (desu) - Possession particle の (no) - Inclusion particle も (mo) - Subject marker が (ga) - Direction particles へ (he) and に (ni) - Self-introductions and greetings (Aisatsu) - Numbers, prices, shopping terms - Days, months, relative time - Family members and occupations

UNIT III KANJI & FUNCTIONAL GRAMMAR 8

Next 50 Kanji (Nature, Core Verbs, Adjectives & Nouns) - Verb groups (Group 1, Group 2, Group 3) - Masu forms (Present, Past, Positive & Negative) - Te-form (~て): requests, connecting sentences, continuous actions (~ている) - Adjective conjugation (い & な adjectives) - Desires (~たい) and Invitations (~ましょう)

UNIT IV VOCABULARY & FUNCTIONAL COMMUNICATION 5

Action verbs (daily routine, hobbies) - Adjectives for people, food, and places - Positional words (inside, outside, next to, between) - Transport, travel, and location vocabulary - Simple conversations in everyday situations

UNIT V READING & LISTENING COMPREHENSION 5

Reading short sentences in Hiragana, Katakana, and basic Kanji - Understanding classroom instructions - Listening to slow, clear daily-life conversations - Understanding simple shopping dialogues

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Identify the Japanese writing system and pronounce basic Japanese words correctly.
- Use basic Japanese vocabulary and simple grammar in sentences.
- Communicate in simple Japanese for everyday situations.
- Read, write, listen to, and understand basic Japanese texts and conversations.
- Apply basic Japanese language skills confidently in simple real-life situations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	-	-	-	-	1	1	1	-	1	2	-	-	-	-
2	-	-	-	-	1	2	2	-	2	2	-	-	-	-
3	-	-	-	-	2	2	2	1	2	3	-	1	-	-
4	-	-	-	-	2	2	2	1	3	3	-	1	-	-
5	-	-	-	-	1	1	1	1	2	3	-	1	-	-
Avg.	-	-	-	-	1.4	1.6	1.6	1.0	0.2	2.6	-	1.0	-	-

1- Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23MDC201	APTITUDE SKILLS (Common to all Branches)	L T P C 3 0 0 0

OBJECTIVES

- To introduce the basics concepts and techniques of numbers, Highest common factor and Least common multiple.
- To develop the use of decimal fraction and problems on ages.
- To introduce the basic concepts of time, work, distance, calendar and clock.
- To explain the student with the concept of simple and compound interest.
- To provide the knowledge of polynomial and quadratic equations.'

UNIT I NUMBERS, HIGHEST COMMON FACTOR AND LEAST COMMON MULTIPLE 9

Numbers and their basic classification – Types of number – Basic operations of numbers – Progression – Tests of divisibility – Highest common factor – Least common multiple

UNIT II DECIMAL FRACTION AND PROBLEMS BASED ON AGES 9

Decimal fraction – Types of fraction – Comparison of fractions – Inserting fractions in between two given fractions – Relation between decimal fraction and normal fraction – Conversion of a decimal fraction into a vulgar fraction – Types of decimals – Conversion of mixed recurring decimal into a vulgar fraction – Standard form of decimal – Problems based on ages.

UNIT III TIME, WORK, DISTANCE, CALENDER AND CLOCK 9

General rule for time and work – General rule for work and wages – Speed – Unit of speed – Average speed – Some useful relations – Problems on Trains – Calendars and clocks – Odd days – Ordinary year – Leap year.

UNIT IV SIMPLE INTEREST, COMPOUND INTEREST AND ELEMENTARY ALGEBRA 9

Simple interest – Compound interest – Some useful relations – Difference between compound interest and simple interest – Short cut methods to solve special types of problems – Elementary Algebra and averages

UNIT V POLYNOMIAL AND QUADRATIC EQUATIONS 9

Polynomial introduction – Degree of a polynomial – Types of polynomial – Operations on polynomial – Remainder and factor theorem – Quadratic equation – Pure Quadratic equation – Discriminant – Roots of the Quadratic equations – Solution of Quadratic equation – Framing of a Quadratic equation – Special types of roots.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Apply basic concepts and techniques highest common factor and least common multiple on numbers.
- Apply the concept of decimal fraction and problems on ages.
- Apply the concept of time, work, distance, calendar and clock.
- Develop proficiency in simple interest, compound interest and basic algebraic skills.
- Explain the concepts and properties of polynomial and quadratic equations.

TEXT BOOKS

1. Agarwal R.S., "Quantitative Aptitude", S. Chand & Company Ltd, New Delhi, 2012.
2. Dinesh Khattar, "Quantitative Aptitude for competitive examinations ", Pearson India Education ServicesPvt. Ltd., New Delhi, 2019.

REFERENCES

1. Praveen R.V., "Quantitative Aptitude and Reasoning", PHI Learning Private Limited, Delhi, 2013
2. Gupta P, "A unique Approach to Quantitative Aptitude ", Unique Publishers (I) Pvt. Ltd, New Delhi, 2017.

E-RESOURCES

1. https://youtube.com/playlist?list=RDQM5Xl256aOq24
2. https://youtu.be/KE7tQf9spPg

Chairman - BoS

SEMESTER III

23MAT304	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	P	T	C
	[Common to Civil, Mech, R&A and PT]	3	1	0	4

OBJECTIVES

- To introduce the basics of Fourier transforms and their properties.
- To compute the Z-transforms of standard functions and their properties.
- To provide knowledge of Fourier series and half-range series.
- To explore the basic concepts of partial differential equation.
- To explain the classification and applications of partial differential equations.

UNIT I FOURIER TRANSFORMS 9+3

Statement of Fourier integral theorem – Fourier transform – Fourier sine and cosine transforms – Properties of Fourier transform – Convolution theorem for Fourier transform – Parseval's identity for Fourier transform.

UNIT II Z-TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z-transforms: Some standard Z-transforms – Elementary properties – Some useful Z-transforms and inverse Z- transforms – Convolution theorem – Evaluation of Inverse Z-transforms by partial fraction method – Application to difference equations.

UNIT III FOURIER SERIES 9+3

Euler's formulae – Conditions for a Fourier expansion – Functions having points of discontinuity – Odd and even function – Half range series – Parseval's formula – Practical Harmonic analysis.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of partial differential equations – Method of separation of variables – Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply various Fourier transform techniques in physical problems of engineering.
- Solve engineering problems using the concept of Z transforms.
- Analyze Fourier series for periodic functions and functions with discrete data.
- Apply the standard types of partial differential equations.
- Evaluate the Fourier series techniques in application of partial differential equations.

TEXT BOOKS

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publishers, Forty fourth Edition, 2022.

2. Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G., "Advanced Mathematics for Engineering Students", S.Viswanathan Publishers, Fourth Edition,1998.

REFERENCES

1. N.P. Bali. and Manish Goyal, "A Textbook of Engineering Mathematics", Laxmi Publications Pvt. Ltd, Nineth Edition, 2014.

2. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Tenth Edition, 2016.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/111/102/111102129/# (Transforms)
2. https://archive.nptel.ac.in/courses/111/103/111103021/ (Partial differential equations)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	2	3	-	-
2	3	3	2	2	2	-	-	-	-	-	2	3	-	-
3	3	3	2	2	2	-	-	-	-	-	2	3	-	-
4	3	3	2	2	2	-	-	-	-	-	2	3	-	-
5	3	3	2	2	2	-	-	-	-	-	2	3	-	-
Avg.	3	3	2	2	2	-	-	-	-	-	2	3	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23MET302 **ENGINEERING MECHANICS** L T P C

(Common to Mechanical Engineering and Robotics and Automaton Engineering) 3 1 0 4

OBJECTIVES

- To train students in the fundamental concepts of mechanics, including scalars, vectors, laws of mechanics, forces, and equilibrium of particles.
- To teach the principles of equilibrium of rigid bodies, moments, couples, and reactions at supports in two and three dimensional systems.
- To develop understanding of friction and its applications in engineering systems such as inclined planes, belts, ladders, and wedges.
- To explain the concepts of centroids and area moments of inertia for simple and composite plane areas.
- To train students in the dynamics of particles, including rectilinear and curvilinear motion, impulse, momentum, and impact of bodies.

UNIT I FUNDAMENTAL CONCEPTS OF MECHANICS 9+3

Introduction to mechanics – Scalars & vectors - Unit conversion – Laws of Mechanics (Parallelogram law, Lami's theorem and Triangular law of forces) – Types of forces acting on a body - Resolution and composition of force – Free body diagram – Equilibrium of a particle - Equivalent system of forces and computation of resultant forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 9+3

Introduction - Varignon's theorem - Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Resolution of a given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III FRICTION 9+3

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – Angle of Repose – Equilibrium of bodies on inclined plane - Belt friction – Ladder friction – Wedge friction – Rolling resistance.

UNIT IV CENTRIODS AND AREA MOMENT OF INERTIA 9+3

Introduction – Centroids of simple Plane Areas and Curves (rectangle, triangle, circle, hollow circle, T-section & I-section) – Area moment of inertia for rectangle, circle, hollow circle, triangle, I-Section and T-Section - Parallel axis theorem and Perpendicular axis theorem. Principle moments of inertia of plane areas.

UNIT V DYNAMICS OF PARTICLES 9+3

Kinematics - Rectilinear Motion and Curvilinear Motion of particles. Principle of Impulse and Momentum - Impact of elastic bodies.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Apply the fundamental concepts of mechanics to resolve forces and determine equilibrium of particles.
- Analyze the equilibrium of rigid bodies by calculating moments, couples, and support reactions in twoand three dimensions.
- Examine the effects of friction in engineering applications such as inclined planes, belts, ladders, and wedges.
- Calculate the centroids and area moments of inertia for simple and composite plane areas using relevant theorems.
- Analyze the motion of particles using principles of kinematics, impulse, momentum, and impact.

TEXT BOOKS

1. Dr.N.Kottiswaran, "Engineering Mechanics", Sri Balaji Publications, Eleventh Edition, 2018.
2. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education, Twelfth Edition, 2019.
3. Vela Murali, "Engineering Mechanics", Oxford University Press, Second Edition, 2018.

REFERENCES

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", Eleventh Edition, Pearson Education, 2017.
2. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, Nineth Edition, Wiley student edition, 2019.
3. Timoshenko S, Young D H, Rao J V and Sukumar Pati, Engineering Mechanics, Fifth Edition, McGraw Hill Higher Education, 2020.

E-RESOURCES

1. https://nptel.ac.in/courses/122/104/122104015/ - ((Engineering Mechanics)
2. https://www.courses.com/indian-institute-of-technology-guwahati/engineering-mechanics - (Engineering Mechanics)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	-	-	-	-	-	-	-	-	2	-	2
2	3	2	2	-	-	-	-	-	-	-	-	2	-	2
3	3	2	2	-	-	-	-	-	-	-	-	2	-	2
4	3	2	2	-	-	-	-	-	-	-	-	2	-	2
5	3	2	2	-	-	-	-	-	-	-	-	2	-	2
Avg.	3	2	2	-	-	-	-	-	-	-	-	2	-	2

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23RMT301 FUNDAMENTALS OF ROBOTICS AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts of robotics and automation and understand their role in modern engineering applications.
- To inculcate the concept of degrees of freedom and various robot movements such as vertical, radial, rotational traverse, roll, pitch, and yaw.
- To focus on the working principles of different grippers including mechanical, vacuum, magnetic, and adhesive grippers.
- To provide knowledge of joint space techniques used for planning robot movements between positions.
- To familiarize with various robotic applications in material handling such as pick and place, palletizing, and depalletizing operations.

UNIT I INTRODUCTION TO ROBOTICS 9

Introduction to Robotics and Automation, laws of robot, brief history of robotics, basic components of robot, robot specifications, classification of robots, human system and robotics, safety measures in robotics, social impact, Robotics market and the future prospects, advantages and disadvantages of robots.

UNIT II ROBOT ANATOMY AND MOTION ANALYSIS 9

Anatomy of a Robot, Robot configurations: polar, cylindrical, Cartesian, and jointed arm configurations, Robot links and joints, Degrees of freedom: types of movements, vertical, radial and rotational traverse, roll, pitch and yaw, Wok volume/envelope, Robot kinematics: Introduction to direct and inverse kinematics, transformations and rotation matrix.

UNIT III ROBOT DRIVES AND END EFFECTORS 9

Robot drive systems: Hydraulic, Pneumatic and Electric drive systems, classification of end effectors, mechanical grippers, vacuum grippers, magnetic grippers, adhesive gripper, gripper force analysis and gripper design, 1 DoF, 2 DoF, multiple degrees of freedom robot hand, tools as end effectors, Robot control types: limited sequence control, point-to-point control, playback with continuous path control, and intelligent control.

UNIT IV PATH PLANNING 9

Definition-Joint space technique, Use of P-degree polynomial-Cubic, polynomial- Cartesian space technique, parametric descriptions, straight line and circular paths, position and orientation planning.

UNIT V ROBOTICS APPLICATIONS 9

Material Handling: pick and place, palletizing and depalletizing, machining loading and unloading, welding & assembly, Medical, agricultural and space applications, unmanned vehicles: ground, Ariel and underwater applications, robotic for computer integrated manufacturing. Types of robots: Manipulator, Legged robot, wheeled robot, aerial robots, Industrial robots, Humanoids, Robots, Autonomous robots, and Swarm robots.

TOTAL : 45 PERIODS

OUTCOMES

Upon the completion of the course, the students will be able to:

- Explain the interaction between human systems and robotic systems along with essential safety measures in robotics.
- Analyze the robot anatomy, configurations, degrees of freedom, work envelope, and basic kinematics involved in robotic motion.
- Examine the robot drive systems, end effectors, gripper mechanisms, and various robot control methods used in robotic operations.
- Apply path planning techniques using joint space and Cartesian space methods for position and orientation control in robotic motion.
- Apply the use of robotics in various applications and classify different types of robots.

TEXT BOOKS

1. S.R. Deb, "Robotics Technology and flexible automation", Tata McGraw-Hill Education,Third Edition, 2022.
2. Robert J. Schilling, "Fundamentals of Robotics" CRC Press, Second Edition, 2020.

REFERENCE BOOKS

1. Dr. Kingsley F. Botto-Danford and Dr. H. Thomas McKenna, "Robotics Engineering – An Integrated Approach", Wiley, Second Edition,2022.
2. Fu K S, Gonzalez R C, Lee C.S.G, "Robotics: Control, Sensing, Vision and Intelligence", McGraw Hill, Second Edition,2019.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/108/112108298 - (Introduction to Robotics)
2. https://archive.nptel.ac.in/courses/112/108/112108298/ - (Motion Planning)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	2	-	-	-	-	-	2	-	3
2	3	2	-	-	-	2	-	-	-	-	-	2	-	3
3	3	2	-	-	-	2	-	-	-	-	-	2	-	3
4	3	2	-	-	-	2	-	-	-	-	-	2	-	3
5	3	2	-	-	-	2	-	-	-	-	-	2	-	3
AVG	3.00	2.00	-	-	-	2.00	-	-	-	-	-	2.00	-	3.00

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23RME301 **DIGITAL ELECTRONICS AND MICROPROCESSOR** L T P C
(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To impart skills in logic minimization using Karnaugh Map (K-Map) and the Quine-McCluskey method.
- To inculcate the design of adders, subtractors, multiplexers, decoders, flip-flops, counters, and shift registers.
- To focus on the concepts of cycles, races, state reduction, and race-free state assignments in asynchronous circuit design.
- To provide knowledge of the pin diagram and functional building blocks of the processor used in microprocessor operations.
- To develop knowledge of programming techniques including loop structures with counting and indexing methods
- To develop practical skills in the design and implementation of digital logic circuits and microprocessor-based programs using the 8085 processor and peripheral interfacing.

UNIT I DIGITAL FUNDAMENTALS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and QuineMcCluskey method of minimization.

UNIT II COMBINATIONAL & SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder -Multiplexer, Demultiplexer, Decoder, Priority Encoder. Flip flops – SR, JK, T, D, design of clocked sequential circuits – Design of Counters- Shift registers, Universal Shift Register

UNIT III ASYNCHRONOUS SEQUENTIAL CIRCUITS AND MEMORY DEVICES 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits. Basic memory structure – ROM -PROM – EPROM – EEPROM – EAPROM, RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA).

UNIT IV 8085 PROCESSOR 9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory rganization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT V PROGRAMMING PROCESSOR 9

Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions – stack -8255 architecture and operating modes

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation Combinational circuits using basic gates for arbitrary functions.
3. Design and implementation of encoder, decoder, multiplexers and demultiplexer.
4. Design and implementation of 3-bit modulo counters as synchronous and Asynchronous types
5. Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes.
6. Basic arithmetic operations of 8085.
7. Move a data block without overlap.
8. Ascending Descending Order.
9. Write a program to control the traffic light system using 8085 & 8255.

TOTAL: 45+15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Apply number systems, codes, Boolean algebra, logic gates, and minimization methods to design and simplify digital circuits.
- Construct combinational and sequential circuits including adders, subtractors, multiplexers, decoders, flip-flops, counters, and shift registers.
- Examine asynchronous sequential circuits, hazards, and memory devices including ROM, RAM, PLDs, PLA, PAL, and FPGA.
- Analyze the 8085 processor architecture, memory organization, I/O operations, timing diagrams, and interrupt handling.
- Interpret assembly language programs and 8255 interfacing to perform data transfer, manipulation, control, and subroutine operations.
- Demonstrate the design, implementation, and verification of digital circuits and 8085/8255 programs for practical applications.

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson, Sixth Edition, 2021.
2. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Prentice Hall of India, Fourth Edition, 2019.

REFERENCES

1. Charles H.Roth. "Fundamentals of Logic Design", Thomson Learning,Seventh Edition, 2019.
2. Thomas L. Floyd, "Digital Fundamentals", Pearson Education Inc, Eleventh Edition, 2019.
3. R.S. Gaonkar, "Microprocessor Architecture Programming and Application with 8085", Wiley Eastern Ltd., Sixth Edition, 2021.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/117/106/117106114/ - (Digital Circuits and systems)
2. https://archive.nptel.ac.in/courses/108/105/108105102/ - (8085 Microprocessor)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	1	1	1	1	-	-	1	-	1	1	3	1
2	3	2	1	1	1	1	-	-	1	-	1	1	3	1
3	3	2	1	1	1	1	-	-	1	-	1	1	3	1
4	3	2	1	1	1	1	-	-	1	-	1	1	3	1
5	3	2	1	1	1	1	-	-	1	-	1	1	3	1
6	-	-	-	-	1	-	-	2	1	2	1	1	3	1
AVG	3.00	2.00	1.00	1.00	1.00	1.00	-	2.00	1.00	2.00	1.00	1.00	3.00	1.00

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23RME302 **ELECTRIC MACHINES AND POWER SYSTEM** L T P C
(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To inculcate the principles, operation, and control of DC machines and motors.
- To impart knowledge of the construction, operation, performance, and applications of transformers in robotics and automation.
- To focus on the principles, construction, operation, and control of single-phase and three-phase induction motors and their applications.
- To familiarize with the construction and functions of synchronous and special machines.
- To provide an overview of the structure of electric power systems including generation, transmission, sub-transmission, and distribution.
- To develop practical skills in testing electrical machines and using MATLAB for system analysis and simulation

UNIT I DC MACHINES 9

Principle and Construction of DC Machines - EMF equation - Methods of excitation – Types - Principle of operation of DC Motor – back emf and torque equation - Characteristics of DC series and shunt motors - Starting of DC Motors, Need for Starters - Speed control and Braking of DC motors (Voltage Control & Dynamic Braking Only) .

UNIT II TRANSFORMERS 9

Constructional Details – Principle of Operation – EMF Equation – Transformation ratio - Transformer on no load – Transformer on load- Regulation - Losses and efficiency - Load test - Three phase transformer connections - Applications of Transformer in Robotics and Automation.

UNIT III INDUCTION MOTORS 9

Principle of Operation of single phase induction motor – Starting of Single phase Induction motor - Construction – Types – Principle of operation of three phase induction motors - Speed Torque characteristics - Equivalent circuit - Starting and Speed control - Introduction to Linear induction motor - PMSIM - Applications.

UNIT IV SYNCHRONOUS AND SPECIAL MACHINES 9

Construction of Synchronous machines - Types – Induced emf - Working principles of: BLDC -Stepper motor - Servomotor – Universal motor.

UNIT V INTRODUCTION TO POWER SYSTEM 9

Structure of electric power systems - Generation, transmission, sub- transmission and distribution systems - EHVAC and EHVDC transmission systems - Substation layout. (Concepts only).

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of self exited DC shunt generator.
2. Load test on dc shunt motor.
3. Speed control of dc shunt motor.
4. Load test on single phase transformer.
5. Load test on Single phase induction motor.

6. Calculation of Transmission Line parameter using MATLAB.
7. Modeling and simulation of a DC motor's speed control using MATLAB.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Explain the principles, construction, characteristics, and operation of DC machines, including speed control, braking, and starting methods.
- Analyze the construction, operation, performance, and applications of single-phase and three-phase transformers.
- Analyze the construction, operation, performance, and applications of single-phase and three-phase induction motors.
- Examine the construction, operation, and applications of synchronous and special machines.
- Apply the structure and components of electric power systems, including generation, transmission, distribution, and substations.
- Demonstrate the operation and performance of DC machines, transformers, induction motors, and transmission systems, including MATLAB simulations.

TEXT BOOKS

1. B.L.Thereja and A.K.Theraja, "A Text of Electrical Technology", S.Chand publications, Volume 2, 2022.
2. V.K.Mehta, Rohit Mehta, "Principles of power system", S. Chand & Company Ltd, New Delhi, Revised Edition, 2021.

REFERENCES

1. B.R.Gupta "Fundamental of Electric Machines" New age International Publishers, Fourth Edition Reprint, 2021.
2. D.P.Kothari, I.J. Nagarath, "Power System Engineering", and McGraw-Hill Publishing Company limited, New Delhi, Third Edition, 2019.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/108/102/108102146/ - (Electrical Machines)
2. https://archive.nptel.ac.in/courses/108/102/108102047/ - (Power System Generation, Transimision and Distribution).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	–	–	2	–	–	–	–	–	1	1	2	1
2	3	3	–	1	2	–	–	–	–	–	1	1	2	1
3	3	3	–	1	2	–	–	–	–	–	1	1	3	2
4	3	2	–	1	1	–	–	–	–	–	1	1	2	2
5	2	2	–	–	1	1	–	–	–	–	1	1	1	2
6	2	2	1	3	3	–	–	1	1	1	2	2	2	2
AVG	2.67	2.33	1.00	1.50	1.83	1.00	–	1.00	1.00	1.00	1.17	1.17	2.00	1.67

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23RME303 **MANUFACTURING PROCESSES AND TECHNOLOGY** L T P C
(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To inculcate knowledge of sand casting processes including moulding materials,
- Patterns, and core making methods.
- To provide knowledge of fusion welding processes and different types of gas welding and their equipment.
- To focus on milling machine specifications and types of milling machines.
- To enhance skills in machine tools and hole-making operations.
- To focus on grinding processes, finishing operations, and gear generation techniques.
- To develop working skills and knowledge in shaping, planing, slotting, and various drilling operations.

UNIT I CASTING PROCESSES 9

Sand casting - Sand moulds - Type of patterns - Pattern materials - Pattern allowances - Types of moulding sand - Properties - Core making - Methods of Sand testing - CO2 process - Moulding machines - Melting furnaces. Working principle of special casting processes - Shell, investment casting - Pressure die casting -Centrifugal casting - Sand Casting defects

UNIT II METAL JOINING PROCESSES 9

Fusion welding processes - Types of Gas welding - Equipments used - Flame characteristics - Filler and Flux materials - Arc welding equipments - Electrodes - Coating and specifications - Principles of Resistance welding - Spot/butt, Seam welding - Percussion welding - Gas metal arc welding - Flux cored – Submerged arc welding - Electro slag welding - TIG welding. Principle and application of special welding processes - Plasma arc welding - Thermit welding - Electron beam welding, Laser Beam Welding, Friction stir welding, Ultrasonic Welding - Weld defect

UNIT III LATHE AND MILLING MACHINE 9

Lathe machine - Centre lathe, tool nomenclature, operations, machining time and power estimation – Milling -Specifications - Types - Cutter nomenclature - Operations - Milling processes - Indexing - Gear forming.

UNIT IV MACHINE TOOLS AND HOLE MAKING 9

Types, Specification and Quick return Mechanisms: Shaper, Planer and Slotter - Hole making operations - drilling, reaming, boring, counter boring, counter sinking and tapping.

UNIT V GRINDING AND GEAR GENERATION 9

Grinding - Types of grinding - Grinding wheel designation and selection - Honing, lapping, super finishing, polishing and buffing - Gear generation - Gear shaping and gear hobbing - Specifications - Cutting spur andhelical gears

LIST OF EXPERIMENTS

1. Mould with solid and split patterns.
2. Mould with loose-piece pattern.
3. Perform facing, plain turning and step turning operations in centre lathe.

4. Perform taper turning, thread cutting and knurling operations in centre lathe.
5. Fabrication of simple structural shapes using welding.
6. Spur gear/contour cutting in milling machine.
7. Keyway cutting in shaper
8. Round to square in shaper
9. Prepare good surface finish on flat metal.
10. Gear generation in hobbing machine.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Categorize metal casting processes, associated defects, merits and demerits.
- Classify the different metal joining processes.
- Apply the components of lathe and milling machine
- Explain the fundamentals of metal cutting in machining operations.
- Apply various machining processes such as Grinding and gear Operation.
- Demonstrate mould preparation using solid, split, and loose-piece patterns for basic casting operations.

TEXT BOOKS

1. P.N.Rao, "Manufacturing Technology", Mc Grawhill Education, Volume 1, Sixth Edition, 2023.
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India, Eighth Edition, 2020.

REFERENCES

1. Rao,P.N, "Manufacturing Technology Foundry, Forming and Welding", Fifth Edition, TMH-2022.
2. Rajput R. K, "Manufacturing Technology", Laxmi Publications (P)Ltd., Fourth Edition, 2021.

E-RESOURCES

1. http://nptel.ac.in/courses/1121 05126/ - (Manufacturing Technology & Metal Cutting andMachine Tools).
2. https://nptel.ac.in /courses/112/105/112105126/ - (Manufacturing Process – II).

Mapping of COS-POS & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	-	-	-	1	-	-	-	-	2	1	2	1
2	2	1	-	-	-	1	-	-	-	-	2	1	2	1
3	2	1	-	-	-	1	-	-	-	-	2	1	2	1
4	2	1	-	-	-	1	-	-	-	-	2	1	2	1
5	2	1	-	-	-	1	-	-	-	-	2	1	2	1
6	3	2	-	-	-	1	-	-	-	-	2	1	2	1
AVG	2.17	1.17	-	-	-	1.00	-	-	-	-	2.00	1.00	2.00	1.00

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23EEC301 **PROFESSIONAL DEVELOPMENT** L T P C
0 0 2 1

OBJECTIVES

To be proficient in important Microsoft Office tools: MS WORD, EXCEL and POWERPOINT.

- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: **10 Hours**

Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: **10 Hours**

Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate and Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyze data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: **10 Hours**

Select slide templates, layout and themes

Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to,

- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements.
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding.
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	2	-	3	-	-	-	1	3	-	-	2	2
2	3	3	2	2	3	-	-	-	-	2	1	1	2	2
3	2	1	2	-	3	-	-	-	2	3	-	-	2	2
AVG	2.3	1.6	2	2	3	-	-	-	1.5	2.6	1	1	2	2

1-Low, 2-Medium, 3-High, "-" - No Correlation

Chairman - BoS

SEMESTER IV

23RMT401 EMBEDDED SYSTEMS AND PROGRAMMING **L T P C**
3 0 0 3

OBJECTIVES

- To introduce the fundamentals, architecture, and instruction set of 8051 microcontrollers.
- To impart knowledge of programming and communication techniques for 8051 microcontrollers, including assembly, C, and serial/I2C/SPI/CAN interfaces.
- To familiarize with peripheral interfacing of 8051 microcontrollers, including I/O devices, sensors, motors, and control programming.
- To discuss the architecture, instruction set, and basic programming of ARM7 processors.
- To inculcate understanding of single board computers, embedded programming, and interfacing techniques.

UNIT I INTRODUCTION TO MICROCONTROLLER 9

Fundamentals Functions of ALU - Microprocessor - Microcontrollers – CISC and RISC – Types Microcontroller - 8051 Family - Architecture - Features and Specifications - Memory Organization -Instruction Sets – Addressing Modes.

UNIT II PROGRAMMING AND COMMUNICATION 9

Fundamentals of Assembly Language Programming – Instruction to Assembler – Compiler and IDE - C Programming for 8051 Microcontroller – Basic Arithmetic and Logical Programming - Timer and Counter - Interrupts – Interfacing and Programming of Serial Communication, I2C, SPI and CAN of 8051 Microcontroller – Bluetooth and WI-FI interfacing of 8051 Microcontroller.

UNIT III PERIPHERAL INTERFACING 9

I/O Programming – Interfacing of Memory, Key Board and Displays – Alphanumeric and Graphic, RTC, interfacing of ADC and DAC, Sensors - Relays - Solenoid Valve and Heater - Stepper Motors, DC Motors - PWM Programming – Closed Loop Control Programming of Servomotor – Traffic Light

UNIT IV ARM PROCESSOR 9

Introduction ARM 7 Processor - Internal Architecture – Modes of Operations – Register Set – Instruction Sets – ARM Thumb - Thumb State Registers – Pipelining – basic programming of ARM 7 - Applications.

UNIT V SINGLE BOARD COMPUTERS AND PROGRAMMING 9

System on Chip - Broadcom BCM2711 SoC – SBC architecture - Models and Languages – Embedded Design – Real Time Embedded Operating Systems - Real Time Programming Languages -– Python for Embedded Systems- GPIO Programming – Interfacing .

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Explain the architecture, memory organization, instruction set, and addressing modes of 8051 microcontrollers.
- Apply assembly and C programming to interface and communicate with 8051 microcontrollers using timers, interrupts, and serial protocols.
- Construct interfacing circuits and control programs for I/O devices, sensors, and motors using 8051 microcontrollers.
- Analyze the ARM7 architecture, pipelining, and instruction sets to optimize processor-based applications.
- Analyze SBC and SoC architecture, and analyze embedded systems, focusing on real-time OS, GPIO, and interfacing.

TEXT BOOKS

1. Frank Vahid and Tony Givargis, "Embedded System Design:A Unified Hardware/Software Introduction", Wiley, Third Edition, 2020.
2. Kenneth J. Ayala, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Cengage Learning, Fourth Edition, 2019.

REFERENCES

1. Simon Monk, "Programming the Raspberry Pi, Second Edition: Getting Started with Python", McGraw Hill TAB, Third Edition, 2020.
2. James W. Stewart, "The 8051 Microcontroller: Hardware, Software, and Interfacing" ,Prentice Hall, Third Edition, 2019.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/106/105/106105193/ - (Introduction to Embedded systems)
2. https://archive.nptel.ac.in/courses/106/105/106105193/ - (ARM instruction Set)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	–	–	1	–	–	–	–	–	1	–	2	1
2	3	3	1	1	2	–	–	–	–	–	1	–	3	2
3	3	2	2	2	3	–	–	1	1	–	1	–	3	3
4	3	2	–	1	2	–	–	–	–	–	1	–	2	2
5	3	2	1	1	2	–	–	1	1	1	2	1	3	3
AVG	3.00	2.20	1.33	1.25	2.00	–	–	1.00	1.00	1.00	1.20	1.00	2.60	2.20

1- Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23RMT402 **SENSORS AND ACTUATORS** **L T P C**
3 0 0 3

OBJECTIVES

- To introduce sensors, their characteristics, signal types, and applications in measurement systems.
- To impart knowledge on inductive and capacitive transducers, including their principles, construction, characteristics, and applications.
- To enhance understanding of actuators, their types, selection, and applications in pneumatic, hydraulic, and electrical systems.
- To familiarize with micro sensors and micro actuators, their principles, types, and applications
- To focus on sensor materials and micro fabrication processing techniques.

UNIT I SENSORS 9

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.

UNIT II INDUCTIVE & CAPACITIVE TRANSDUCER 9

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros, microsyn. Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT III ACTUATORS 9

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Cor.trol valves; Construction, Characteristics and Types, Selection criteria.Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle ofoperation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.

UNIT IV MICRO SENSORS AND MICRO ACTUATORS 9

Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.

Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

UNIT V SENSOR MATERIALS AND PROCESSING TECHNIQUES 9

Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Explain the principles, characteristics, and applications of sensors, transmitters, and transducers.
- Understand the principles, construction, characteristics, and applications of inductive and capacitive transducers.
- Construct electrical, pneumatic, and hydraulic actuator systems.
- Analyze the principles, types, and performance of micro sensors and micro actuators for different applications.
- Categorize sensor materials and processing techniques for designing and developing sensor devices.

TEXT BOOKS

1. Hans-Peter Baeumler and Hans-Joachim Albrecht, "Micro system Technology and Microbotics", Springer, Third Edition, 2019.
2. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application",Springer, Fifth Edition, 2020.

REFERENCES

1. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, Second Edition, 2023.
2. Thomas. G. Bekwith and Lewis Buck.N, "Mechanical Measurements", Oxford and IBH publishing Co. Pvt. Ltd., Seventh Edition ,2019.

E-RESOURCES

1. https://www.slideshare.net/saaz1425/dc-motor-23906628(DC Motor principles)
2. https://www.electricaleasy.com/2014/01/basic-working-of-dc-motor.html (Motor working animation)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	–	–	1	–	–	–	–	–	1	–	2	1
2	3	2	–	1	1	–	–	–	–	–	1	–	2	1
3	3	2	2	1	2	–	–	1	1	–	1	–	3	3
4	3	3	1	2	2	–	–	–	–	–	1	–	3	2
5	3	2	2	1	2	–	–	–	–	–	2	–	2	2
AVG	3.00	2.20	1.67	1.25	1.60	–	–	1.00	1.00	–	1.20	–	2.40	1.80

1-Low 2-Medium 3-High '- – No Correlation

Chairman - BoS

23RMT403 **KINEMATICS AND DYNAMICS OF ROBOTS** L T P C
3 0 0 3

OBJECTIVES

- To introduce concepts of object positioning, orientation, and coordinate transformations in robotic systems.
- To inculcate understanding of direct kinematics using D-H representation and ARM equations for different robot types.
- To familiarize with inverse kinematics and solution techniques for SCARA and articulated robots.
- To enhance understanding of workspace analysis and trajectory planning for SCARA and articulated robots.
- To acquire knowledge of manipulator dynamics using Lagrange-Euler and Newton-Euler formulations.

UNIT 1 INTRODUCTION 9

Introduction, position and orientation of objects, objects coordinate frame Rotation matrix, Euler angles Roll, pitch and yaw angles coordinate Transformations, Joint variables and position of end effector, Dot and cross products, coordinate frames, Rotations, Homogeneous coordinates.

UNIT II DIRECT KINEMATICS 9

Link coordinates D-H Representation, The ARM equation. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.

UNIT III INVERSE KINEMATICS 9

The inverse kinematics problem, General properties of solutions. Tool configuration, Inverse kinematics of four axis SCARA robot and three and five axis, Articulated robot.

UNIT IV WORKSPACE ANALYSIS AND TRACJECTORY PLANNING 9

Workspace Analysis, work envelope of a Four axis SCARA robot and five axis articulated robot workspace fixtures, the pick and place operations, Joint space technique – continuous path motion, Interpolated motion, straight line motion and Cartesian space teclmique in trajectory planning.

UNIT V MANIPULATOR DYNAMICS 9

Introduction, Lagrange's equation kinetic and potential energy. Link inertia Tensor, link Jacobian Manipulator inertia tensor. Gravity, Generalized forces, Lagrange-Euler Dynamic model, Dynamic model of a Two-axis planar robot, Newton Euler formulation, Lagrange - Euler formulation, problems.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Understand position, orientation, and coordinate transformations of robots.
- Apply D–H representation and arm equations to determine the direct kinematics of SCARA and articulated robots.
- Construct inverse kinematic solutions for SCARA and articulated robots.

- Develop the ability to calculate and define the work envelope and operational limits of different robotic systems.
- Analyze dynamic models of robotic systems, including a two-axis planar robot, using Euler's method

TEXT BOOKS

1. R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw Hill, Third Edition, 2021.
2. JohnJ.Craig, "Introduction to Robotics Mechanics and Control", Pearson Education, Fourth Edition, 2021.

REFERENCES

1. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, Second Edition, 2019.
2. Edwin Wise, "Applied Robotics", Cengage Learning, Second Edition, 2022.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/105/112105236 - (Forward Kinematics)
2. https://archive.nptel.ac.in/courses/112/105/112105268 - (Kinematic Modeling)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO11	PO12	PSO1	PSO2
1	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
2	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
3	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
4	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
5	3	3	3	1	-	-	-	-	-	-	3	-	1	-	2
AVG	3.00	3.00	3.00	1.00	-	-	-	-	-	-	3.00	-	1.00	-	2.00

1.Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

23RME401	PLC AND SCADA	L T P C
	(Lab Embedded Theory Course)	3 0 2 4

OBJECTIVES

- To introduce the fundamentals of industrial automation, PLC architecture, control elements, and safety standards.
- To impart knowledge of PLC programming, including relay ladder logic, function block diagrams, timers, counters, and data manipulation.
- To enhance knowledge of PLC networking and industrial communication protocols.
- To discuss HMI systems, their types, and interfacing with PLCs for industrial automation applications.
- To foster understanding of SCADA systems, including architecture, communication protocols, and PLC/field device interfacing.
- To enhance hands-on experience in PLC programming, I/O interfacing, and automation of motors, traffic lights, and conveyor systems.

UNIT I INTRODUCTION 9

History and developments in Industrial Automation - Vertical Integration of Industrial Automation - Control elements in Industrial Automation – Safety standards - PLC Introduction to Industrial Automation : Basics of History and developments in Industrial Automation - Vertical Integration of Industrial Automation - Control elements in Industrial Automation - Safety standards - PLC Introduction : Basics of PLC - Advantages - Capabilities of PLC - Architecture of PLC - Scan cycle - Types of PLC : Types of I/O modules - Configuring a PLC - PLC wiring – Redundant systems.

UNIT II PROGRAMMING OF PLC 9

Introduction to state machine theory - Types of Programming – IEC61131 Standard - Process Control Programs using Relay Ladder Logic – FBD, structure, arithmetic functions - Timers and counters –data transfer- Comparison and manipulation instructions - PTO /PWM generation.

UNIT III NETWORKING OF PLCS 9

Industrial Networking Buses (Flow Diagram Only) - Introduction to Industrial Buses - Protocols - Device Net - Ethernet - IP, Modbus TCP - Ether CATor CAN bus protocol - Details of CAN bus.

UNIT IV HMI SYSTEMS 9

Necessity and Role of HMI in Industrial Automation – Types of HMI panels :Text display - operator panels - Touch panels - Panel PCs - Integrated displays, Interfacing PLC to HMI: Case studies of Machine automation, Process automation.

UNIT V SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) 9

SCADA overview - Developer and runtime packages - Architecture - Tools - Tag - Internal & External graphics - Alarm logging - Tag logging - Trends - History - Report generation - Communication Protocols of SCADA - Open Protocols. OLE/OPC, OPCUA - DDE - Server/Client - Interfacing of SCADA with PLC and other field devices

LIST OF EXPERIMENTS

1. Write and Implement Ladder logic diagram for Boolean functions and verification using I/O devices.
2. Write and implementation of simple ladder logic program using timer: on, off & Retentive timer using PLC.
3. Write and implementation of simple ladder logic program using (up & down) counter.
4. Write and implement ladder logic program to on-off the DC motor using PLC.
5. Simulation of PLC wiring for three phase induction motor starting and direction control.
6. Study about the traffic light controller system by using PLC.
7. Study about conveyor control system using PLC.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Categorize the fundamental control elements and adhere to international safety standards required for industrial environments.
- Construct PLC programs using relay ladder logic, FBD, timers, counters, and data manipulation instructions
- Apply industrial bus protocols and their use in PLC networking and integration.
- Classify HMI types and analyze their roles and interfacing with PLCs in industrial automation.
- Analyze SCADA architecture, protocols, and integration with PLCs and field devices.
- Apply PLC programming and ladder logic to implement timers, counters, motor control, and automation systems such as traffic lights and conveyor systems.

TEXT BOOKS

1. John W Webb and Ronald A Reis , "Programmable logic controllers: Principles and Applications", Prentice Hall India, 2019.
2. Hans Berger , "Automating with Simatic S7-1200", Publicis Publishing, Third Edition, 2020.

REFERENCES

1. Kelvin T Erikson , "Programmable Logic Controllers", Dogwood Valley Press, 2020.
2. R.S.Manoj, "Industrial Automation with SCADA : Concepts, Communications and Security", Notion Press, 2019.

E RESOURCES

1. https://nptel.ac.in/courses/108105088 - (Industrial Automation and control).
2. https://nptel.ac.in/courses/108105063 - (Introduction to Industrial Automation).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2	1	–	1	3	2	–	–	–	1	1	2	2
2	2	2	1	1	2	–	–	–	2	–	1	1	2	3
3	2	2	1	1	2	3	2	–	2	–	1	1	2	3
4	3	3	2	2	3	–	–	–	1	–	1	1	3	3
5	3	2	1	1	2	–	–	–	1	–	1	1	2	3
6	3	2	1	2	2	–	–	3	2	–	1	1	3	3
AVG	2.50	2.17	1.17	1.40	2.00	3.00	2.00	3.00	1.60	–	1.00	1.00	2.33	2.83

1-Low 2-Medium 3-High '-' – No Correlation.

Chairman - BoS

23MEE402 **STRENGTH OF MATERIALS** L T P C
(Lab Embedded Theory Course) 3 0 2 4
(Common to Mechanical and Robotics and Automation)

OBJECTIVES

- To teach different types of stresses and strains, axial and thermal effects, elastic constants, and factor of safety in solids.
- To explain principal stresses, stresses on inclined planes, Mohr's circle, and stresses in thin and thick-walled cylinders.
- To familiarize learners with bending and shear stress distribution, load carrying capacity, and proportioning of beam sections.
- To guide learners in evaluating beam deflections and column strength using standard methods and formulas.
- To teach torsion in shafts, stresses in helical and carriage springs, and related practical examples
- To guide students in performing experiments and demonstrate practical measurements of stress, strain, hardness, deflection, torsion, and heat treatment effects.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Stresses types -Tension, Compression and Shear Stresses - Hooke's law - Stresses and strains due to axial force in stepped and composite bars - Stresses due to thermal effect in composite bars - Factor of safety - Poisson ratio - Elastic constants and their relationship.

UNIT II STRESSES IN TWO DIMENSIONS 9

Stresses on inclined planes - Principal planes and Principal stresses - Mohr's circle for bi-axial stress with shear stress - Analytical and Graphical methods. Hoop and longitudinal stresses in thin and thick cylindrical vessels, Maximum Shear stress, Changes in dimensions and volume.

UNIT III TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAMS 9

Types of supports, Loads and beams - Shear force and bending Moment in cantilever, simply supported and overhanging beams. Theory of simple bending - Bending stress distribution – Load carrying capacity - Proportioning of sections - Shear stress distribution.

UNIT IV DEFLECTION OF BEAMS AND COLUMNS 9

Evaluation of slope and deflection of cantilever and simply supported beams – Double integration method - Macaulay's method. Types of Columns, Equivalent length, Euler and Rankine formulae, Slenderness ratio.

.UNIT V TORSION IN SHAFT AND HELICAL SPRING 9

Torsion of circular solid and hollow shafts - Shear strength - Angle of twist and torsional stiffness - Stresses in helical springs - Deflection of helical springs, carriage springs.

LIST OF EXPERIMENTS

1. Tension test on steel rod in U.T.M.
2. Torsion test on steel rod.
3. Impact test on metal specimen.

4. Hardness test on metals - Brinell and Rockwell Hardness.
5. Deflection test on beams.
6. Spring Test - Open coil and Closed coil.
7. Effect of Hardening – improvement of hardness and impact resistance of steels
8. Tempering- Improvement Mechanical properties Comparison
   (i) Unhardened specimen
   (ii) Quenched Specimen and
   (iii) Quenched and tempered specimen.
9. Double shear test on metal
10. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon completion of the course, Students will be able to:

- Examine how variations in material properties and structure configurations affect the overall stress and strain responses.
- Analyze the importance of two dimensional stress systems and stresses in thin and thick cylinders.
- Draw the shear force and bending moment diagrams for beams subjected to various loading conditions, such as point loads, distributed loads, and moments.
- Apply the impact of estimated slopes and deflections on the overall design and safety of structural components.
- Apply torsion equation in design of circular shafts and helical springs.
- Examine how the results from different tests compare and what they reveal about the specimen's overall mechanical behavior.

TEXT BOOKS

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, Sixth Edition, 2021
2. Rajput R K., "A Textbook of Strength of Materials (Mechanics of Solids)", S Chand and Company Ltd., Fourth Edition, 2020.
3. F.P. Beer and R.Johnston, "Mechanics of Materials", McGraw Hill Education India (P) Ltd., Seventh Edition, 2023.

REFERENCES

1. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, Second Edition, 2021.
2. Egor P Popov, "Engineering Mechanics of Solids", Prentice Hall of India, Fourth Edition, 2023.
3. Rattan.S.S, "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., Fourth Edition, 2023.

E-RESOURCES

1. https://nptel.ac.in/courses/112/107/112107146 - (Strength of Materials)
2. https://nptel.ac.in/courses/105/105/105105108/ - (Introduction to Strength of Materials)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	-	-	1	1	-	-	-	-	3	2	2
2	3	3	1	-	-	1	1	-	-	-	-	3	2	2
3	3	3	1	-	-	1	1	-	-	-	-	3	2	2
4	3	3	1	-	-	1	1	-	-	-	-	3	2	2
5	3	3	1	-	-	1	1	-	-	-	-	3	2	2
6	3	3	1	-	-	1	1	-	2	-	-	3	2	2
Avg.	3	3	1	-	-	1	1	-	2	-	-	3	2	2

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23GEE301 **PROBLEM SOLVING AND PYTHON PROGRAMMING** L T P C
(Lab Embedded Theory Course) 3 0 2 4

OBJECTIVES

- To impart the fundamentals of computational thinking, algorithm design, and problem-solving techniques for developing efficient software solutions.
- To develop students proficiency in Python programming using data types, expressions, operators, statements, and debugging techniques.
- To enable students to apply control structures, functions, recursion, and string manipulation for solving computational problems.
- To train students to use lists tuples, dictionaries, and advanced data processing techniques for structured programming.
- To inculcate the knowledge of file handling, exception handling, modules, packages, and data visualization for developing robust Python applications.
- To develop the students in analytical, programming, and computational skills through coding practices, and to solve real-world problems using Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocksofalgorithms(statements,state,controlflow,functions),notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

Coding practices:

1. Develop Algorithm and flowchart to find the greatest of three numbers.
2. Develop Algorithm and flowchart to find a minimum number in a List.

Problem-solving Assignments:

1. Develop Algorithm and Flowchart to solve Towers of Hanoi Problem.
2. Develop Algorithm, Pseudo code and flowchart for finding factorial of a given number using recursion.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

Coding practices:

1. Develop python program to find area of a Circle
2. Develop python program to convert Fahrenheit to Celsius.

Problem-solving Assignments:

1. Develop Python program to find Quadratic Equation
2. Develop Python program to find Student mark statement based on 5 subjects.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions:

return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

Coding practices:

1. Develop python program to find GCD of a given number.
2. Develop python program to find factorial of a number.
3. Develop Python program to find sum of array of given numbers.

Problem-solving Assignments:

1. Develop Python program to find whether an element is found in the List by using (A) Linear Search and (B) Binary Search method
2. Develop Python program to print Fibonacci Series

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation

Coding practices:

1. Develop python program for Insertion Sorting & Selection Sorting.
2. Develop python program for Histogram

Problem-solving Assignments:

1. Develop Python program for student mark statement using List
2. Develop Python program to print Retail bill statement

UNIT V FILES, MODULES, PACKAGES& DATA VISUALIZATION 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file - Importing Matplotlib – Introduction to plotting – visualizing errors – density and contour plots – Histograms.

Coding practices:

1. Develop python program to append the contents of one file to another.
2. Develop python program to copy contents of one file to another file using command Line Arguments

Problem-solving Assignments:

1. Develop a python program for calculator using python packages.
2. Develop a suitable python program to demonstrate each case in Exceptional Handling
3. Develop a suitable python program using Matplotlib for Visualizing Errors

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3. Scientific problems using Conditionals and Iterative loops.(Number series, Number Patterns, pyramid pattern)
4. Implementation of real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementation of real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets &Dictionaries)
6. Implementation of programs using Functions.(Factorial, largest number in a list, area of shape)
7. Implementation of programs using Strings.(reverse, palindrome, character count, replacing characters)
8. Implemenation of programs using written modules and Python Standard Libraries (p and as, numpy. Matplotlib, scipy)
9. Implementation of real-time/technical applications using File handling.(copy from one file to another, word count, longest word)
10. Implementation of real-time/technical applications using Exception handling.(divide by zero error, voter's age validity, student mark range validation)

TOTAL : 45 +15 = 60 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Analyze computational problems to develop effective problem-solving strategies.
- Apply python constructs to develop programs for python applications.
- Apply control structures and functions to solve computational problems.
- Apply Python built-in data structures such as lists, tuples, and dictionaries to process and manipulate data efficiently.
- Analyze the operations of file handling, exception handling, modules, packages, and data visualization techniques for real-world applications.
- Implement python programs for solving various computational problems.

TEXTBOOKS

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", O'Reilly Publishers, Second Edition, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", BCS Learning & Development Limited, First Edition, 2017.

REFERENCES

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, First Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", Notion Press, First Edition, 2021.

E – RESOURCES

1. https://nptel.ac.in/courses/106104074(Introduction to Algorithms)
2. https://archive.nptel.ac.in/courses/106/106/106106182/ (Joy of Computing)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	2	-	-	-	-	-	-	2	-	-
2	3	2	2	-	3	-	-	-	-	-	-	2	-	-
3	3	3	2	1	3	-	-	-	-	-	-	2	-	-
4	3	2	2	-	3	-	-	-	-	-	-	2	-	-
5	2	3	2	2	3	-	-	-	-	1	-	2	-	-
6	3	3	3	2	3	-	-	1	1	2	1	2	-	-
Avg.	2.83	2.667	2.16	1.5	2.83	-	-	1	1	1.5	1	2	-	-

1 - Low 2 - Medium 3 - High '-' – No Correlation

Chairman - BoS

23EEC401 **ONLINE CERTIFICATION COURSES** **L T P C**
3 0 0 3

Students may be permitted to study online courses (NPTEL, SWAYAM or any Proctored Assessment Certification Courses) with 3 credits during the 4th semester curriculum for all B.E./B.Tech. Programmes. Such courses offered to students shall be recommended by the Department Academic Committee (DAC). The DAC shall ensure that the courses offered are not core courses in their respective curriculum.

The number of credits and transfer of credits are based on the procedure explained in following Table. The mapping of marks with grades is applicable only if the student passes the course as per the guidelines of NPTEL.

S.No.	No. of Weeks	Credits
1	4	1
2	8	2
3	12	3
4	16	4

Chairman - BoS

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

SCHEME

MINOR DEGREE / HONOURS

SENGUNTHAR ENGINEERING COLLEGE
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DEPARTMENT OF ROBOTICS AND AUTOMATION

REGULATIONS 2023

MINOR DEGREE / HONOURS

INDUSTRIAL ROBOTICS

CURRICULUM AND SYLLABI

Estd. 2001

CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS - INDUSTRIAL ROBOTICS)

B.E- ROBOTICS AND AUTOMATION

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23RMIT01	Introduction to Robotics	PC	3	0	0	3	40	60	100
23RMIT02	Principles of Industrial Robotics	PC	3	0	0	3	40	60	100
23RMIT03	Applied and Industrial Robotics	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23RMIE01	Robotic Process Automation	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23RMIP01	Project Work	EEC	0	0	12	6	60	40	100

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

SEMESTER III

23RMIT01 **INTRODUCTION TO ROBOTICS** **LT P C 3 0 0 3**

OBJECTIVES

- To familiarize students with robot anatomy, classification, and industrial automation strategies.
- To introduce robotic gripper design and the integration of sensing and vision systems.
- To provide knowledge on drive types, transmission systems, and closed-loop control architectures.
- To impart proficiency in programming methods and languages from VAL to ROS
- To inculcate awareness of AI techniques, safety standards, and the economic impacts of robotics.

UNIT I INTRODUCTION TO ROBOTICS **9**

Brief History, Basic Concepts of Robotics such as Definition , Three laws, Elements of Robotic Systems i.e. Robot anatomy, DOF, Misunderstood devices etc., Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, etc., Associated parameters i.e. resolution, accuracy, repeatability, dexterity, compliance, RCC device etc., Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot.

UNIT II GRIPPERS AND SENSORS FOR ROBOTICS **9**

Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot.

UNIT III DRIVES AND CONTROL FOR ROBOTICS **9**

Drive - Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system. Control Systems: Types of Controllers, Introduction to closed loop control.

UNIT IV PROGRAMMING AND LANGUAGES FOR ROBOTICS **9**

Robot Programming: Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, Python, ROS etc., Development of languages since WAVE till ROS.

UNIT V ARTIFICIAL INTELLIGENCE IN ROBOTICS **9**

Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, New trends & recent updates in robotics.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to;

- Explain the terminologies related to Robotics technology.
- Analyze the various grippers and sensors for robotics.
- Apply logic for drives and control robotic systems
- Apply the Programming and Languages
- Develop knowledge of AI techniques in the area of robotic technology.

TEXT BOOKS

1. S.K.Saha, "Introduction to Robotics", TATA Mc Graw Hills Education, Second Edition, 2021.
2. Asitava Ghoshal," Robotics": Fundamental concepts and analysis, Oxford University Press, First Edition, 2019.

REFERENCES

1. S. B. Niku," Introduction to Robotics" – Analysis, Control, Applications, Third Edition, John Wiley & Sons Ltd., 2020.
2. R. D. Klafter, Thomas A. Chmielewski, and Mechael Negin," Robotic Engineering" – An Integrated Approach, EEE, Prentice Hall India, Pearson Education Inc. 2020.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/107/106/107106090/ - (Introduction to robotics)
2. https://archive.nptel.ac.in/courses/107/106/107106090/Robot – (Kinematics and anatomy)

Mapping of COs-POs &PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	1	1	1	2	-	-	-	-	-	-	1	2	2
2	2	1	1	1	2	-	-	-	-	-	-	1	2	2
3	2	1	1	1	2	-	-	-	-	-	-	1	2	2
4	2	1	1	1	2	-	-	-	-	-	-	1	2	2
5	2	1	1	1	2	-	-	-	-	-	-	1	2	2
AVG	2.00	1.00	1.00	1.00	2.00	-	-	-	-	-	-	1.00	2.00	2.00

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER IV

23RMIT02 **PRINCIPLES OF INDUSTRIAL ROBOTICS** **LT P C 3 0 0 3**

OBJECTIVES

- To impart knowledge on the history, elements, and hierarchical levels of industrial automation systems.
- To introduce the principles of fluid power systems and the application of Boolean algebra in logic gates.
- To familiarize students with material handling equipment, AGVs, and automated assembly machine configurations.
- To provide an understanding of PLC hardware architecture, I/O modules, and Human Machine Interface (HMI).
- To develop awareness of microprocessor integration, feedback devices, and the fundamentals of SCADA.

UNIT I INTRODUCTION TO AUTOMATION **9**

History, Elements of Automation, Types of Automation systems, Applications of Automation, Goals of Automation, low cost automation, Hierarchical levels in industrial automation systems.

UNIT II FLUID POWER AND FLUID POWER SYSTEMS **9**

Introduction to fluid power- Classification of fluid power systems, comparison of electrical, hydraulic and Pneumatic systems; Basic circuit diagram of Hydraulic fluid power and pneumatic power systems, Components of Hydraulic fluid power systems, Components of Pneumatic power system, Logic Gates, Truth tables and Boolean algebra.

UNIT III ASSEMBLY AUTOMATION EQUIPMENT **9**

Material Handling: Principles of Material Handling, Material handling equipment- Wheel conveyor, Gravity Roller conveyor, Chain conveyor, Flat belt conveyor, Magnetic belt conveyor, bucket conveyor, Vibrating conveyor, screw conveyor, vertical lift conveyor, trolley conveyor, Sortation conveyor, cranes and Hoists, storage equipment, AS/RS, AGV.

Transfer and assembly equipment: Introduction to feeder units, Cycled transfer equipment and non-cycled transfer equipment. Automated assembly machines: Dial indexing machine, In-line machine, and floating work platform machines.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS **9**

Programmable Logic Controllers (PLC): Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers, PLC Size and Applications.

PLC hardware Components: The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, Typical Discrete I/O Module Specifications, Typical Analog I/O Module Specifications, The Central Processing Unit (CPU),Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs).

UNIT V MICROPROCESSORS AND MICROCONTROLLERS 9

Evolution of microprocessors and microcontrollers; Architectures of microprocessors and microcontrollers; Integration of mechanical systems with computer and electronic systems (Mechatronic systems). Feedback devices: LVDT, Linear/Rotary encoders, absolute encoders, resolvers and potentiometers, Fundamentals of SCADA and Data Acquisition Systems.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to;

- Develop the process of automation and its different applications.
- Analyze functional characteristics of power systems for industrial applications.
- Apply knowledge of assembly automation equipment and its related components.
- Apply the concepts of programming logic controller units for industrial applications.
- Apply the techniques of microprocessors and microcontrollers in integrating mechanical systems with computer and electronic systems.

TEXT BOOKS

1. Khushdeep Goyal, "Industrial Automation and Robotics", S.K.Kataria & Sons, Fourth Edition, 2021.
2. Frank. D.Petruzella, "Programmable Logic Controllers", Tata McGraw-Hill Education, Fourth Edition, 2021.

REFERENCES

1. M.P.Groover, Automation, Production systems and Computer Integrated Manufacturing, PHI Learning, Fifth Edition, 2020.
2. Geoffrey Boothroyd, Assembly Automation and Product design, Taylor and Francis Publishers, Third Edition, 2019.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/112/105/112105249/ - (Fluid power and fluid systems)
2. https://archive.nptel.ac.in/courses/112/105/112105249/ - (Industrial Automation)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	-	2	-	1	-	-	-	-	1	3	1
CO 2	3	2	2	-	2	-	1	-	-	-	-	1	3	1
CO 3	3	2	2	-	2	-	1	-	-	-	-	1	3	1
CO 4	3	2	2	-	2	-	1	-	-	-	-	1	3	1
CO 5	3	2	2	-	2	-	1	-	-	-	-	1	3	1
AVG	3.00	2.00	2.00	-	2.00	-	1.00	-	-	-	-	1.00	3.00	1.00

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER V

23RMIT03	APPLIED AND INDUSTRIAL ROBOTICS	L T P C 3 0 0 3

OBJECTIVES

- To impart knowledge on robot-centered cell design, assembly configurations, and vision-based inspection systems.
- To familiarize students with robot performance testing, safety barriers, and industrial selection criteria.
- To introduce the principles of cooperative manipulation, multi-agent systems, and swarm robotic algorithms.
- To provide an understanding of field robots in agriculture, construction, and hazardous search-and-rescue missions.
- To develop awareness of medical robotic systems, rehabilitation aids, and smart prosthetic technologies.

UNIT I ROBOT MATERIAL HANDLING 9

General considerations in Robot material handling, material transfer application, machine loading and unloading, CNC machine tool loading, Robot centered cell Assembly and parts presentation methods, Assembly operation, Compliance and the Remote center compliance (RCC) Device, Assembly system configurations, Adaptable programmable assembly system, Designing for robotic assembly, Inspection automation - vision inspection system, robot - manipulated inspection.

UNIT II EXPERT SYSTEMS 9

Factors influencing the choice of a robot, Robot performance testing - Path/point accuracy and repeatability, Maximum working envelop, Kinematic and State values. Robot safety Considerations, Factors affecting robot safety measures, Safety features built into industrial robot, Safety barriers and other devices.

UNIT II COOPERATIVE AND SWARM ROBOTS 9

Cooperative manipulation, Challenges in cooperative manipulation- Case studies for Cooperative manipulation for Industrial and Service applications; Introduction to swarm Robots, Comparison with other multi-agent systems, challenges and benefits of swarm systems- Algorithms for swarm Robots, application, case study of swarm Robots.

UNIT IV FIELD ROBOTS 9

Forestry, Robot locomotion, Forestry automation, Broad acre Applications- Automatic guidance, sowing, weeding, spraying and broad-acre harvesting; Horticulture, Picking of fruits, Robot milking, Sheep shearing, Slaughtering, livestock inspection, Robots in construction, Future directions; Robots for hazardous applications, Enabling technologies- Search and Rescue robotics: Disaster characteristics-Impact on Robots, Robots actually used at disaster, Promising robots, open issues – Case studies; Cleaning Robots, lawn moving Robots- Smart appliances and smart homes.

UNIT V ROBOTS IN HEALTH CARE **9**

Medical robotics, Core concepts, Technology- Medical robotic systems, Research areas and applications; Rehabilitation and Health care robotics- Overview, physical therapy and training Robots; Robotic aid for people with disabilities- Smart prostheses and orthoses, diagnosis and monitoring.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to;

- Apply the knowledge of robotic material handling and assembly systems.
- Analyze the expert systems in robotic performance testing and safety
- Explain the concepts of various cooperative and SWARM robots and its applications.
- Analyze robotic configurations and specifications for field and service applications.
- Develop the core concepts of robots in medical applications.

TEXT BOOKS

1. Mikell P. Groover, Mitchell Weiss, "Industrial Robotics Technology, Programming and Applications", TataMc Graw Hill Book company, Fourth Edition, 2021.
2. Bernard Hodges," Industrial Robotics", Jaico Publishing House, Second Edition, 2020.

REFERENCES

1. Yangsheng Xu Huihuan Qian Xinyu Wu, "Household and Service Robots", Elsevier Ltd, 2018.
2. LMarques,AdeAlmeida,Mo Tokhi,GSVirk, "Advances in Mobile Robotics", World Scientific Publishing Co. Pvt. Ltd. 2019.

E-RESOURCES

1. https://nptel.ac.in/courses/120108004 - (Environment Management)
2. https://archive.nptel.ac.in/courses/112/105/112105249/ - (Industrial robots and its application)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	-	2	-	-	1	-	-	-	1	3	1
2	3	2	2	-	2	-	-	1	-	-	-	1	3	1
3	3	2	2	-	2	-	-	1	-	-	-	1	3	1
4	3	2	2	-	2	-	-	1	-	-	-	1	3	1
5	3	2	2	-	2	-	-	1	-	-	-	1	3	1
AVG	3.00	2.00	2.00	-	2.00	-	-	1.00	-	-	-	1.00	3.00	1.00

1-Low 2-Medium 3-High '- ' – No Correlation

Chairman - BoS

SEMESTER VI

23RMIE01	ROBOTIC PROCESS AUTOMATION (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

- To impart RPA architecture, SDLC differences, and business case standardization.
- To introduce tool interfaces, variable management, and advanced control flow logic.
- To focus on the advanced automation and its techniques.
- To enhance the level of handling, debugging and logging operations.
- To impart deploy and maintain the software bot.
- To develop the practical skills the basics of fundamentals of robotics systems.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

UNIT II RPA TOOL INTRODUCTION AND BASICS 9

Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.

UNIT III ADVANCED AUTOMATION CONCEPTS & TECHNIQUES 9

Recording Introduction - Basic and Desktop Recording - Web Recording - Input/output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT IV HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING 9

Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. EXCEPTION HANDLING: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

UNIT V DEPLOYiNG AND MAINTAINING THE BOT 9

Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages

Fundamentals of Robotics Lab

List of Experiments

1. Study and analysis of robot grippers (includes the problems based on gripper force)
2. Demonstration of various robotic configurations using industrial robot
3. MATLAB program for simple kinematics of simple robot configuration
4. MATLAB program for inverse kinematics of simple robot configuration
5. To demonstrate simple robotic system using MATLAB/ MscAdam / Robo Analyser software
6. Study of configuration of robots and motion of robot manipulator
7. Study of pick and place industrial robot
8. One Industrial visit for Industrial robotic application

TOTAL = 45+15 = 60 PERIODS

OUTCOMES

Upon completion of this course, the students will be able to;

- Explain the basics of RPA and its applications.
- Apply basic RPA tools and control flow activities.
- Apply advanced RPA techniques for process automation.
- Analyze events and handle exceptions in RPA.
- Apply techniques to deploy and maintain RPA bots.
- Apply robotic concepts, kinematics, grippers, configurations, and industrial robot operations to demonstrate and analyze robotic systems.

TEXT BOOKS

1. Alok Mani Tripathi, "Learning Robotic Process Automation", Packt Publishing, Second Edition, 2019.
2. Lim Mei Ying, "Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes", Packt Publishing, First Edition, 2018.

REFERENCES

1. Frank Casale, Rebecca Dilla, Heidi Jayne's, Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation, First Edition, 2019.

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant", Independently Published, First Edition, 2020.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/107/106/107106090/ -(Introduction to automation process.)
2. https://nptel.ac.in/courses/107/106/107106090/-(Robotic Process Automation).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	2	2	-	-	1	-	1	-	1	3	2
2	3	3	3	2	2	-	-	1	-	1	-	1	3	2
3	3	3	3	2	2	-	-	1	-	1	-	1	3	2
4	3	3	3	2	2	-	-	1	-	1	-	1	3	2
5	3	3	3	2	2	-	-	1	-	1	-	1	3	2
6	3	3	3	3	-	-	-	-	3	3	-	1	3	2
AVG	3.00	3.00	3.00	2.17	2.00	-	-	1.00	3.00	1.33	-	1.00	3.00	2.00

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER VII

23RMIP01 **PROJECT WORK** **L T P C**
0 0 12 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work is 6.
- There shall be three reviews (Zeroth Review,(Review I and Review II, 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 Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

Upon completion of the course, the students will be able to:

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO11	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

Chairman - BoS

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

DEPARTMENT OF ROBOTICS AND AUTOMATION

REGULATIONS 2023

MINOR DEGREE / HONOURS

AI FOR ROBOTICS

CURRICULUM AND SYLLABI

Estd. 2001

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(MINOR DEGREE / HONOURS)

AI FOR ROBOTICS

B.E- ROBOTICS AND AUTOMATION

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
THEORY									
23RMAT01	Fundamentals of Robotic System and Robot Programming	PC	3	0	0	3	40	60	100
23RMAT02	Fundamentals of Artificial Intelligence for Robotics	PC	3	0	0	3	40	60	100
23RMAT03	Machine Learning for Robotics	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23RMAE01	Advanced Control Systems Drivers for Robots	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23RMAP01	Project Work	EEC	0	0	12	6	60	40	100

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

SEMESTER III

23RMAT01	FUNDAMENTALS OF ROBOTIC SYSTEM AND ROBOT PROGRAMMING	LT P C 3 0 0 3

OBJECTIVES

- To impart knowledge on robot anatomy, joints, links, and various drive system architectures.
- To introduce mechanical gripper mechanisms, force analysis, and feedback control devices like LVDT.
- To familiarize students with kinematic transformations, homogeneous coordinates, and robotic sensing technologies.
- To provide an understanding of work cell design, mobile robots, and micro/nano-robotics fabrication.
- To develop proficiency in robot programming types, coordinate systems, and controller motion commands.

UNIT I INTRODUCTION 9

Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and links-Robot classifications-Architecture of robotic systems-Robot Drive systems- Hydraulic, Pneumatic and Electric system.

UNIT II END EFFECTORS AND ROBOT CONTROLS 9

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type-Magnetic grippers-Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT III ROBOT TRANSFORMATIONS AND SENSORS 9

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple transformation-Simple problems. Sensors in robot – Touch sensors-Tactile sensor – Proximity and range sensors – Robotic vision sensor-Force sensor-Light sensors, Pressure sensors.

UNIT IV ROBOT CELL DESIGN AND MICRO/NANO ROBOTICS SYSTEM 9

Robot work cell design and control-Sequence control, Operator interface, Safety monitoring devices in Robot-Mobile robot working principle, actuation using MATLAB, NXT Software Introductions- Robot applications- Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot. Micro/Nano Robotics system overview-Scaling effect- Top down and bottom up approach- Actuators of Micro/Nano robotics system- Nano robot communication techniques-Fabrication of micro/Nano grippers-Wall climbing micro robot working principles-Bio mimetic robot-Swarm robot-Nano robot in targeted drug delivery system.

UNIT V BASICS OF ROBOT PROGRAMMING **9**

Robot programming-Introduction-Types- Flex Pendant- Lead through programming, Coordinate systems of Robot, Robot controller- major components, functions-Wrist Mechanism-Interpolation- Interlock commands- Operating mode of robot, Jogging-Types, Robot specifications- Motion commands, end effectors and sensors commands..

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Apply the basic Concept of robot.
- Analyze the end effectors types and Robot Controls.
- Apply the concepts of Robot Transformations and Sensors.
- Explain about the Robot Cell Design.
- Apply the Robot Programming concepts and types of languages in robot systems.

TEXT BOOKS

1. Craig. J. J. "Introduction to Robotics mechanics and control", Pearson Education Fourth Edition, 2019.
2. S.R. Deb, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, Second Edition, 2019.

REFERENCES

1. Mikell. P. Groover, "Industrial Robotics Technology", Tata McGraw Hill Co, Third Edition, 2020.
2. Klafter. R.D, Chmielewski.T.A. and Noggin"s., "Robot Engineering : An Integrated Approach", Prentice Hall of Indiaz Pvt. Ltd., Second Edition, 2021.

E-RESOURCES

1. https://nptel.ac.in/courses/107106090 - (controls and systems.)
2. https://archive.nptel.ac.in/courses/112/101/112101099/-(Robot end effectors and gripper systems).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	-	2	-	-	1	-	-	-	1	3	1
2	3	2	2	-	2	-	-	1	-	-	-	1	3	1
3	3	2	2	-	2	-	-	1	-	-	-	1	3	1
4	3	2	2	-	2	-	-	1	-	-	-	1	3	1
5	3	2	2	-	2	-	-	1	-	-	-	1	3	1
AVG	3.00	2.00	2.00	-	2.00	-	-	1.00	-	-	-	1.00	3.00	1.00

1-Low 2-Medium 3-High '-' – No Correlation

Chairman - BoS

SEMESTER IV

23RMAT02	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE FOR ROBOTICS	LT P C 3 0 0 3

OBJECTIVES

- To introduce the fundamentals of Artificial Intelligence, including its history, cognitive processes, and intelligent agents.
- To impart knowledge on problem formulation and the application of uninformed and informed search strategies for effective problem solving.
- To focus on AI programming using LISP and PROLOG, and symbolic logic with non-deductive inference methods.
- To inculcate knowledge of AM potentials, complex geometries, and customization strategies.
- To familiarize students with AI applications in robotics, including perception, mapping, motion control, and ethical considerations.

UNIT I INTRODUCTION 9

Introduction – History, Definition of AI, Emulation of human cognitive process, Intelligent agents – The concept of rationality, the nature of environments, the structure of agents.

UNIT II SEARCH METHODS 9

Problem – Solving Agents : Problem Definitions, Formulating Problems, Searching for solutions – Measuring Problem – Solving Performance with examples. Search Strategies : Uninformed search strategies – Breadth – first Search, Uniform – Cost Search, depth –first search, depth – limited search, Iterative deepening depth – first search, bidirectional search, comparing uniformed search strategies. Informed search strategies – Heuristic information, Hill climbing methods, best – first search, branch – and – bound search, optimal search and A* and Iterative deepening A*.

UNIT III PROGRAMMING AND LOGICS IN ARTIFICIAL INTELLIGENCE 9

LISP and other programming languages – Introduction to LISP, Syntax and numerical function, LISP and PROLOG distinction, input, output and local variables, interaction and recursion, property list and arrays alternative languages, formalized symbolic logics – properties of WERS, non-deductive inference methods.

UNIT IV EXPERT SYSTEM 9

Potential of AM, Potentials and Resulting Perspectives - Complex Geometries, Integrated Geometry, Integrated Functionalities, Multi-Material Parts and Graded Materials. AM-Based New Strategies – Customization.

UNIT V AI IN ROBOTICS 9

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Explain the basics of AI, human cognitive emulation, and the structure of intelligent agents.
- Identify and apply appropriate problem-solving and search strategies.
- Analyze AI programs in LISP and PROLOG and evaluate symbolic logic and non-deductive inference methods.
- Apply additive manufacturing concepts for complex geometries and customized parts.
- Examine AI applications in robotics, including perception, mapping, motion control, and ethical considerations.

TEXT BOOKS

1. Russell Stuart, Norvig Peter, "Artificial Intelligence Modern Approach", Pearson Education series in AI, Third Edition, 2020.
2. Dan.W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", PHI Learning, Second Edition, 2021.

REFERENCES

1. Donald.A.Waterman, "A guide to Expert Systems", Pearson, First Edition, 2020.
2. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution",Crabtree Publishing Company, Second Edition, 2019.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/1011080470040/ - (Search methods in robots.)
2. https://onlinecourses.nptel.ac.in/1011080470040/ - (Programming languages in robots.)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	1	1	-	-	1	-	2	3	3
2	3	3	3	3	2	-	1	-	-	-	-	1	3	3
3	3	3	3	3	3	1	1	1	-	1	-	1	3	3
4	3	3	2	3	3	-	1	-	-	-	-	1	3	3
5	3	2	3	2	3	-	1	-	-	-	-	1	3	2
AVG	3.00	2.80	2.80	2.80	2.80	1.00	1.00	1.00	-	1.00	-	1.20	3.00	2.80

1-Low 2-Medium 3-High '-' – No Correlation

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SEMESTER V

23RMAT03 **MACHINE LEARNING FOR ROBOTICS** **LT P C 3 0 0 3**

OBJECTIVES

- To impart knowledge on machine learning varieties, input-output functions, and performance evaluation metrics.
- To introduce foundational supervised models including decision trees, k-nearest neighbors, and logistic regression.
- To familiarize students with gradient descent, support vector machines, and probabilistic Naïve Bayes modeling.
- To provide an understanding of dimensionality reduction, K-means clustering, and expectation-maximization algorithms.
- To develop proficiency in neural network representations, backpropagation, and AI-driven robotic navigation case studies.

UNIT I INTRODUCTION **9**

Machine learning – Varieties of Machine learning – Learning Input- Output functions: Types of learning – Input Vectors – Outputs – Training regimes – Noise – Performance Evaluation.

UNIT II FOUNDATIONS OF SUPERVISED LEARNING **9**

Decision trees and inductive bias – Geometry and nearest neighbour's – Logistic regression – Perceptron – Binary classification.

UNIT III ADVANCED SUPERVISED LEARNING **9**

Linear models and gradient descent – Support Vector machines – Naïve Bayes models and probabilistic modelling – Model selection and feature selection – Model Complexity and Regularization.

UNIT IV UNSUPERVISED LEARNING **9**

Curse of dimensionality, Dimensionality Reduction, PCA, Clustering – K- means – Expectation Maximization Algorithm – Mixtures of latent variable models – Supervised learning after clustering – Hierarchical clustering.

UNIT V NEURAL NETWORKS **9**

Network Representation, Feed-forward Networks, back propagation, Gradient- descent method. Case Studies: Line following using Supervised Learning techniques – A simulation model for understanding both regression and classification techniques - Study of the effectiveness of the Bias-variance. Obstacle avoidance and navigation of a mobile robot in an unknown environment with the help of Neural Network -Use of stochastic PCA and the PCA neural network to find low dimensional features. Building a feed- orward neural network to ascertain automatic navigational queries.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

- Classify machine learning types based on training regimes and performance evaluation metrics.
- Build supervised models using decision trees and logistic regression for binary classification.
- Analyze linear models and Support Vector Machines (SVM) using gradient descent techniques.
- Compare K-means and hierarchical clustering methods to address the curse of dimensionality.
- Construct feed-forward neural networks to solve robotic obstacle avoidance and navigation tasks.

TEXT BOOKS

1. Sebastian Thrun,"Machine Learning for Robotics" Cambridge University Press, Second Edition, 2022.
2. Gonzalez-Brenes, "Machine Learning for Autonomous Robotics" , Springer , Second Edition, 2022.

REFERENCES

1. Dragos Crisan, "Machine Learning in Robotics: Methods and Applications", IntechOpen , Second Edition, 2022.
2. Peter Corke, "Robotics, Vision & Control: Fundamental Algorithms in MATLAB", Springer, Third Edition, 2020.

E-RESOURCES

1. https://archive.nptel.ac.in/courses/106/106/106106202/ -(Introduction to machine learning)
2. https://www.youtube.com/watch?v=QlhHqMnd9Wo - (Introduction to neural networks)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	2	1	2	-	-	-	-	-	-	2	3	1
2	3	2	2	1	2	-	-	-	-	-	-	2	3	1
3	3	2	2	1	2	-	-	-	-	-	-	2	3	1
4	3	2	2	1	2	-	-	-	-	-	-	2	3	1
5	3	2	2	1	2	-	-	-	-	-	-	2	3	1
AVG	3.00	2.00	2.00	1.00	2.00	-	-	-	-	-	-	2.00	3.00	1.00

1-Low 2-Medium 3-High '-' – No Correlation

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SEMESTER VI

23RMAE01 ADVANCED CONTROL SYSTEMS DRIVERS FOR ROBOTS **LT P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

- To develop knowledge of digital control systems and discrete-time signals.
- To impart knowledge of stability methods for discrete systems.
- To enhance skills in modeling digital control systems and designing compensators.
- To impart knowledge on control system analysis using state variable methods, including state equations, eigenvalues, controllability, and observability.
- To enhance understanding of state variable analysis in digital control systems, including pulse transfer functions, state equations, controllability, and observability.
- To inculcate fundamental knowledge of sampling, reconstruction, and basic discrete-time signals in digital control systems.

UNIT I INTRODUCTION **9**

Configuration of the basic Digital Control Systems, types of sampling operations, Sample and Hold operations, Sampling theorem, Basic discrete time signals.

UNIT II STABILITY METHODS **9**

Mapping between s-plane and z-plane, stability methods: Modified Routh Criterion, Jury"s method, modified Schur-Cohn criterion.

UNIT III MODELS OF DIGITAL CONTROL SYSTEMS **9**

Digital temperature control System, Digital position control system, stepping motors and their control. Design of Digital compensator using frequency response plots.

UNIT IV CONTROL SYSTEMS ANALYSIS USING STATE VARIABLE METHODS **9**

State variable representation, conversion of state variable models to transfer function and vice-versa, Eigen values and eigen vectors, Solution of state equations, Concepts of controllability and observability.

UNIT V STATE VARIABLE ANALYSIS OF DIGITAL CONTROL SYSTEMS **9**

State variable description of digital control systems, conversion of state variable models to pulse transfer function and vice versa, solution of state difference equations, controllability and observability.

LIST OF EXPERIMENTS

1. Simulation of Sampling and Reconstruction in Digital Control Systems
2. Generation and Analysis of Basic Discrete-Time Signals
3. Stability Analysis of Digital Control System Using z-Plane Methods
4. Modeling and Simulation of Digital Position Control System
5. State-Space Modeling and Analysis of Robotic Actuator
6. State-Space Analysis of Digital Control System for Stepper Motor

TOTAL: 45+15 =60PERIODS

OUTCOMES

Upon completion of the course, the students will be able to,

- Explain the configuration, sampling operations, and basic discrete-time signals in digital control systems
- Apply Routh, Jury, and Schur-Cohn methods to determine system stability.
- Construct models of digital control systems and compensators.
- Apply state variable methods to analyze digital control systems.
- Analyze digital control systems using state variable models, and evaluate controllability, observability, and system responses.
- Illustrate and simulate sampling, reconstruction, and discrete-time signals in digital control systems.

TEXT BOOKS

1. M.Gopal, "Digital Control and State Variable Methods", Tata Mc-Graw-Hill., Second Edition, 2017.
2. K.Ogata, "Discrete Time Control Systems", Pearson Education, Second Edition, 2015.

REFERENCES

1. I.J. Nagrath and M. Gopal, "Control Systems Engineering" New Age International Publishers, Eighth Edition, 2019 .
2. K.K. Aggarwal, "Control System Analysis and Design", Khanna Publishers, Sixth Edition,2014

E-RESOURCES

1. https://nptel.ac.in/courses/108103008 (Digital Control System)
2. https://nptel.ac.in/courses/108103007 (Advanced Control Systems)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3	3	3	1	1	1	2	1	-	1	3	3
2	3	3	3	3	3	-	-	1	2	1	-	1	3	3
3	3	3	3	2	3	1	1	2	3	2	-	2	3	3
4	3	3	2	3	3	-	-	2	2	1	-	2	3	3
5	3	3	3	3	3	1	1	2	3	2	-	2	3	3
6	3	3	3	3	2	-	1	1	2	1	-	1	3	3
AVG	3.00	3.00	2.83	2.83	2.83	1.00	1.00	1.50	2.33	1.33	-	1.50	3.00	3.00

1-Low 2-Medium 3-High '-' – No Correlation

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SEMESTER VII

23RMAP01 **PROJECT WORK** **L T P C**
0 1 2 6

OBJECTIVES

- To develop knowledge to formulate a real world problem and projects goals.
- To identify the various tasks of the project to determine standard procedures.
- To identify and learn new tools, algorithms and techniques.
- To understand the various procedures for validation of the product and analysis the cost effectiveness.
- To understand the guideline to Prepare report for oral demonstrations.

PROCESS DESCRIPTION

- For Project work out of 100 marks, the maximum marks for Continuous Internal Assessment is fixed as 60 and the End Semester Examination (project report evaluation and viva voce examination) carries 40 marks. Project work shall be assigned to a single student.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work is 6.
- There shall be three reviews (Zeroth Review,(Review I and Review II, 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 Department shall constitute a review committee for each programme. There shall be a minimum of three members in the review committee.
- The committee shall consist of the Supervisor, Project Coordinator and one of the faculty members.
- The student(s) is expected to submit the project report on or before the last working day of the semester. The ESE for the project work shall consist of the evaluation of the final project report submitted by the student or students of the project group by an external examiner, followed by a viva-voce examination conducted separately for each student by a committee consisting of the external examiner and an internal examiner (other than supervisor). The project coordinator shall be the internal examiner. The COE shall appoint the External Examiner for the ESE of the Project Work. The project report shall be submitted as per the approved guidelines given by Controller of Examinations.

OUTCOMES

Upon completion of the course, the students will be able to:

- Formulate real-world problems.
- Design and express technical solutions using appropriate tools and techniques.
- Test and validate prototypes for efficiency and cost-effectiveness, and present their work effectively through reports and oral demonstrations.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-Low, 2-Medium, 3-High, "-" - No Correlation

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SENGUNTHAR ENGINEERING COLLEGE
(AUTONOMOUS)
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SCHEME

CREDIT SUMMARY

CREDIT SUMMARY

FOR B.E. / B.Tech. DEGREE PROGRAMMES

MINOR DEGREE / HONOURS

(INDUSTRIAL ROBOTICS / AI FOR ROBOTICS)

B.E. ROBOTICS AND AUTOMATION

Category	Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	-	-	-	-	-	-	-	-	-
BS	-	-	-	-	-	-	-	-	-
ES	-	-	-	-	-	-	-	-	-
PC	-	-	3	3	3	4	-	-	13
PE	-	-	-	-	-	-	-	-	-
OE	-	-	-	-	-	-	-	-	-
EEC	-	-	-	-	-	-	6	-	6
MC	-	-	-	-	-	-	-	-	-
Total	-	-	3	3	3	4	6	-	19