



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



CURRICULUM & SYLLABI

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

(CHOICE BASED CREDIT SYSTEM)

REGULATIONS – 2023

(REVISION I)

(I - VI SEMESTER)

(For the students admitted from the Academic year 2023-2024 and 2024-2025)



Note: The regulations here under 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 under going the programme 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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VISION AND MISSION OF THE INSTITUTE

Vision

To be a prominent center for academia transforming the life of aspiring minds by imparting professional, technical, ethical, entrepreneurial skills and research attitude to address global challenges.

Mission

- M1** To train students to develop into competitive professionals and entrepreneurs with high ethical standards.
- M2** To offer a contemporary and flexible curriculum, industry collaborative teaching and learning processes to achieve academic excellence in Engineering and Technology.
- M3** To establish research centres of excellence in niche areas to foster research for addressing local and global challenges.
- M4** To engage students in extension activities and outreach programmes for social development.





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REGULATIONS 2023

CHOICE BASED CREDIT SYSTEM

B. E. ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

- To develop the students into competent professionals in the field of Electronics and Communication Engineering through education, entrepreneurial skills, research with ethical practice to meet the global standards.

MISSION

- To nurture the students to develop competence in emerging technologies with ethical standards through practical exposure.
- To establish the Centre of Excellence in specialized areas through collaborative learning to address the local and global challenges.
- To involve students in enrichment activities that address the societal needs.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Graduates can :

- Gain strong foundation in designing, manufacturing, testing, operating and maintaining systems in the field of Electronics and Communication Engineering or allied engineering industries.
- Engage in lifelong learning, research and solve social relevance problems by adapting new ideas, tools and technologies.
- Communicate effectively and manage resources skillfully as entrepreneurs, members and leaders of the profession.





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PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1	Engineering Knowledge	Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem analysis	Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4).
PO3	Design/development of solutions	Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct investigations of complex problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO6	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)..
PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9).
PO8	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences





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PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8).

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO1	Specify, design, and develop complex systems in the areas of IoT, VLSI, embedded systems, signal processing, communication systems and networking.
PSO2	Select and apply cutting-edge hardware and software tools to solve engineering problems relevant to Electronics and Communication Engineering.





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MAPPING OF COURSE OUTCOME AND PROGRAM OUTCOME															
Year	Sem	Course Name	PO											PSO	
			1	2	3	4	5	6	7	8	9	10	11	1	2
I	I	23HST101 – PROFESSIONAL ENGLISH	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-
		23MAT101 - MATRICES AND CALCULUS	3	3	2	-	-	-	-	-	-	-	2	-	-
		23PHE103 - APPLIED PHYSICS FOR ELECTRONICS ENGINEERING	3	3	1	1	-	-	-	-	-	-	-	-	-
		23CYE101 - ENGINEERING CHEMISTRY	2.2	2.0	2.6	1.75	1.80	1.75	1.5	1.6	1.25	1.33	1.25	-	-
		23HST102 – தமிழர் மரபு / HERITAGE OF TAMILS	-	-	-	-	-	-	2	1	2	-	1	-	-
		23GEE101 - PROGRAMMING IN C	2.3	2.3	2.0	1.4	2.5	-	1	1	1.3	1	1.7	2.5	2.2
		23EEEC101 - SOFT SKILLS & LIFE SKILLS	1	1.6	0.6	0.4	0.6	1.4	0.4	2.6	2.8	2.6	1.6	-	-
		23MDC101 - INDUCTION PROGRAM (2 WEEKS)	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	23MAT202 DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS	3	2.4	2	1.4	2	-	-	-	-	-	2	-	-
		23PHT203 ADVANCED PHYSICS FOR ELECTRONICS ENGINEERING	3	2	1	1	-	-	-	-	-	-	-	-	-
		23CYT201 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	2	2	3	2	2.2	3	3	2	2.6	2.4	2.2	-	-



		23HST202 – தமிழரும் தொழில்நுட்பமும் / TAMILS AND TECHNOLOGY	-	-	-	-	-	-	2	1	-	-	1	-	-
		23HSE201 - ENGLISH FOR ENGINEERS: THEORY AND PRACTICE	1	2	-	2	1	2	1.5	2.3	3	2	1.6	-	-
		23EEE201 - ELECTRIC CIRCUIT ANALYSIS	3	3	3	3	3	-	-	-	2	1	1	3	1
		23GEL201 – ENGINEERING PRACTICES LABORATORY	3	2	-	-	1	1	-	-	-	-	2	2	1
		23GEL202 - ENGINEERING DRAWING FOR ELECTRICAL AND ELECTRONICS	3	2	-	-	2	1	-	-	3	-	2	-	-
		23EEC201 - INDIAN LANGUAGE (EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE													
		23EEC201 - Hindi	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-
		23EEC201 - German	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	-	-
		23EEC201 - Japanese	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-
		23MDC201 - APTITUDE SKILLS	-	-	-	-	-	-	-	-	-	-	-	-	-
II	III	23MAT302 - TRANSFORMS AND RANDOM PROCESSES	3.0	3.0	2.0	3.0	2.0	-	-	-	-	-	1.0	-	-
		23ECT301 – SIGNALS AND SYSTEMS	3.0	3.0	3.0	3.0	3.0	2.0	-	-	-	-	3.0	3.0	1.0
		23EET303 - CONTROL AND INSTRUMENTATION ENGINEERING	3.0	3.0	3.0	3.0	-	-	1.0	-	2.0	-	2.0	3.0	2.0



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IV	23ECE302 - DIGITAL SYSTEMS DESIGN	3.0	3.0	3.0	2.0	2.0	2.0	-	-	-	2.0	2.0	3.0	3.0
	23GEE301 - PROBLEM SOLVING AND PYTHON PROGRAMMING	2.8	2.7	2.2	1.5	2.8	0.0	1.0	1.0	1.5	1.0	2.0	3.0	2.8
	23EEEC301 - PROFESSIONAL DEVELOPMENT	-	-	-	-	-	-	-	-	-	-	-	-	-
	23ECT401 - ELECTROMAGNETIC FIELDS	3	3	3	3	3	2	1	-	1	1	2	3	2
	23ECT402 - NETWORKS AND SECURITY	2	2	1	2	2	1	1			1	2	2	2
	23ECT403 - MICROPROCESSORS AND MICROCONTROLLERS	3	3	3	3	3	3	-	-	-	2	2	3	3
	23ECE401 - DIGITAL SIGNAL PROCESSING	3	3	3	3	3	3	-	-	-	3	3	3	3
	23ECE402 - COMMUNICATION SYSTEMS	3	3	3	3	3	1	1	-	-	1	1	2	3
	23ECE403 - LINEAR INTEGRATED CIRCUITS	3	3	3	3	2	2	2	-	-	1	2	3	2
	23EEEC401 - ONLINE CERTIFICATION COURSES	-	-	-	-	-	-	-	-	-	-	-	-	-
III	23ECT501 - TRANSMISSION LINES AND RF SYSTEMS	3	3	2	3	3	1	-	-	-	-	1	3	1.6
	PROFESSIONAL ELECTIVE I													
	23ECP501 - WIDE BANDGAP DEVICES	3	3	3	3	3	3	-	-	-	-	1	3	2





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23ECP502 - VALIDATION AND TESTING TECHNOLOGY	3	3	3	3	3	3	-	-	-	-	2	3	2
23ECP503 - LOW POWER IC DESIGN	2.8	2.8	2.4	2.4	2.4	-	-	-	-	1.4	2	2	
23ECP504 - VLSI TESTING AND DESIGN FOR TESTABILITY	2	2	2	2	1	1.5	-	-	-	1	2	3	2.6
23ECP505 - MIXED SIGNAL IC DESIGN TESTING	3	3	2.8	2.2	1.8	1.8	-	-	-	-	2.2	2.4	2
23ECP506 - ANALOG IC DESIGN	3	3	2.6	2.2	1.8	1.8	-	-	-	-	2.2	2.4	2
PROFESSIONAL ELECTIVE II													
23ECP507 - ADVANCED DIGITAL SIGNAL PROCESSING	3	3	3	2	1.8	1.8	-	-	-	-	1.6	2.4	2.4
23ECP508 - IMAGE PROCESSING	3	3	3	2	2	2	-	-	-	-	2	2	2
23ECP509 - SPEECH PROCESSING	1.8	2	1.8	1.8	2	1.8	-	-	-	-	1.8	2	2.4
23ECP510 - SOFTWARE DEFINED RADIO	3	3	3	2	2	2	-	-	-	1	2	2	2
23ECP511 - DSP ARCHITECTURE AND PROGRAMMING	3	3	3	2	2	2	-	-	-	1	2	2	3
23ECP512 - COMPUTER VISION	2.6	2.6	2.4	1.8	2.4	0.4	-	2	1	2.2	2.4	2.6	2.2
PROFESSIONAL ELECTIVE III													
23ECP513 - WEARABLE DEVICES	3	2	1	1	2	-	1	-	-	-	-	1	1
23ECP514 - MEDICAL ELECTRONICS	3	3	2.6	2.4	2.8	2.4	-	-	-	-	2.4	2.8	2.2





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		23ECP515 - THERAPEUTIC EQUIPMENT	3	2.8	2.6	3	2	3	2	-	-	-	2	2.6	2.6
		23ECP516 - MEDICAL IMAGING SYSTEMS	3	3	2.8	2.2	2	1.6	-	-	-	-	2	2	2.4
		23ECP517 - BRAIN COMPUTER INTERFACE AND APPLICATIONS	3	3	3	2	2.4	1.6	-	-	-	-	1.8	2	2.4
		23ECP518 - BODY AREA NETWORKS	2.4	2.2	1.4	1.4	1	1.4	1.4	-	-	-	1	3	3
		23ECE501 - VLSI AND CHIP DESIGN	3	3	3	3	3	2	-	-	-	2	2	3	3
		23ECE502 - OPTICAL AND MICROWAVE ENGINEERING	3	3	3	3	3	2	-	-	-	-	1	2	2
	MANDATORY COURSES I														
		23MDC501- INTRODUCTION TO WOMEN AND GENTER STUDIES	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC502- ELEMENTS OF LITERATURE	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC503- FLIM APPRECIATION	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC504- DISASTER RISK REDUCTION AND MANAGEMENT	-	-	-	-	-	-	-	-	-	-	-	-	-
		23MDC505- CONSTITUTION OF INDIA	-	-	-	-	-	-	-	-	-	-	-	-	-
		23EEC501 - INDUSTRIAL TRAINING	-	-	-	-	-	-	-	-	-	-	-	-	-
	VI	23ECT601 - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	3	3	3	3	3	3	-	-	-	-	1	2	3
		PROFESSIONAL ELECTIVE IV													





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23ECP601 - RF TRANSCEIVERS	3	3	3	3	2	-	-	-	1	-	2	3	3
23ECP602 - SIGNAL INTEGRITY	3	3	3	2	2	2	-	-	-	-	2	2	2
23ECP603 - ANTENNA AND WAVE PROPAGATION	3	3	3	3	3	1	-	-	-	1.6	1	3	2
23ECP604 - MICs AND RF SYSTEM DESIGN	3	3	3	3	3	1	-	-	1	-	2	3	2
23ECP605 - EMI/EMC PRE COMPLIANCE TESTING	3	3	3	3	3	2	-	-	1	-	2	2	1.6
23ECP606 - RFID SYSTEM DESIGN AND TESTING	3	3	3	2	3	3	-	-	1	-	2	3	3
PROFESSIONAL ELECTIVE V													
23ECP607 - ROCKETRY AND SPACE MECHANICS	3	3	3	2	2	2	-	-	-	-	2	2	2
23ECP608 - WIRELESS SENSOR NETWORK DESIGN	2.8	3	2.2	2	2.2	1.4	-	-	-	2	2.2	2.6	1.6
23ECP609 - INDUSTRIAL IOT 4.0	2	1	3	1	2	-	-	-	2	2	3	3	2
23ECP610 - FUNDAMENTALS OF NANOELECTRONICS	3	3	3	3	3	3	-	-	-	-	2	3	3
23ECP611 - UNDERWATER COMMUNICATION	3	3	3	3	2	3	-	-	-	-	1	2	2
23ECP612 - OCEAN ACOUSTICS	3	3	3	2	2	2	-	-	-	-	2	-	-
PROFESSIONAL ELECTIVE VI													
23ECP613 - WIRELESS BROAD BAND NETWORKS	3	3	3	3	3	1.6	-	-	-	2	3	2	3





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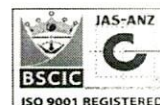
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23ECP614 – 4G/5G COMMUNICATION NETWORKS	3	2.8	2.6	2.6	2	-	-	-	-	-	-	1.8	2.2
23ECP615 – SOFTWARE DEFINED NETWORKS	3	3	3	2	2	2	-	-	-	-	2	3	2
23ECP615 – MASSIVE MIMO NETWORKS	3	3	2.4	2.4	2.4	2.4	-	-	-	-	1.4	2	1
23ECP617 – ADVANCED WIRELESS COMMUNICATION TECHNIQUES	3	3	3	2.8	2.8	2.8	-	-	-	-	2	1	1
23ECP618 – SATELLITE COMMUNICATION	3	3	3	3	3	1	-	-	-	-	2.2	3	2.6
OPEN ELECTIVE I													
23CEO607 - ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT	3.0	3.0	2.4	2.0	2.0	2.2	3.0	-	-	-	2.3	-	-
23CSO610 - INTRODUCTION TO DRONE TECHNOLOGIES	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-
23ECO602 - FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-
23EEO603 – ELECTRIC VEHICLE TECHNOLOGY	3	3	3	3	3	-	-	-	-	-	2	-	-
23EEO604 - RENEWABLE ENERGY SYSTEMS	3	3	3	3	3	1	1	-	1	-	2	-	-
23MEO601 - INTRODUCTION TO INDUSTRIAL ENGINEERING	3	3	2	-	-	-	-	-	-	-	2	-	-
23MEO605 – CNC MACHINING TECHNOLOGY	3	3	2	2	3	-	-	-	-	-	1	-	-
23MDO611 – HOSPITAL MANAGEMENT	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-
23RAO609 - FUNDAMENTALS OF ROBOTICS	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-





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23CSO612 - CYBER FORENSICS AND ETHICAL HACKING	3	2.6	1.75	2.25	2.6	1.6	2.2	1	1.5	1	2	-	-
23PMO608 - PHARMACEUTICAL NANOTECHNOLOGY	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-
23MAO606 - GRAPH THEORY	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-
23NCCL01 - NCC AIRFORCE LEVEL-1	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	-	-
23NCCL03 - NCC ARMY WING LEVEL-3	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-
23ECE601 - EMBEDDED SYSTEMS AND IOT DESIGN	3	3	3	2	2	-	-	-	-	-	-	3	3
23EEJ601 - PROJECT WORK - PHASE I	3	3	3	3	3	3	3	3	3	3	3	3	3
MANDATORY COURSE II													
23MDC601- WELL BEING WITH TRADITIONAL PRACTICES- YOGA, AYURVEDA AND SIDDHA	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC602- HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC603- POLITICAL AND ECONOMICAL THOUGHT FOR A	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC604- STATE, NATION BUILDING AND POLITICS IN INDIA	-	-	-	-	-	-	-	-	-	-	-	-	-
23MDC605- INDUSTRIAL SAFETY	-	-	-	-	-	-	-	-	-	-	-	-	-





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



SCHEME FOR CURRICULUM

B.E. –Electronics and Communication Engineering



CURRICULUM AND SYLLABI

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

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

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
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									
23PHE103	Applied Physics for Electronics Engineering	BS	3	0	2	4	50	50	100
23CYE101	Engineering Chemistry	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 :	Tota



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CURRICULUM AND SYLLABI

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

B.E. - ELECTRONICS AND COMMUNICATION ENGINEERING - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit C	Maximum Marks		
			L	T	P		CIA	ESE	TOT
THEORY									
23MAT202	Differential Equations and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT203	Advanced Physics for Electronics Engineering	BS	3	0	0	3	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23HST202	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	1	0	0	1	40	60	100
EMBEDDED COURSE									
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	100
23EEE201	Electric Circuit Analysis	PC	3	0	2	4	50	50	100
PRACTICALS									
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23GEL202	Engineering Drawing for Electrical & Electronics	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						25			

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



CURRICULUM AND SYLLABI

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

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

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING -THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks			
			L	T	P		C	CIA	ESE	TOT
THEORY										
23MAT302	Transforms and Random Processes	BS	3	1	0	4	40	60	100	
23ECT301	Signals and Systems	PC	3	1	0	4	40	60	100	
23EET303	Control and Instrumentation Engineering	ES	3	0	0	3	40	60	100	
EMBEDDED COURSE										
23ECE301	Electronic Devices and Circuits	PC	3	0	2	4	50	50	100	
23ECE302	Digital Systems Design	PC	3	0	2	4	50	50	100	
23GEE301	Problem Solving and Python Programming	ES	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
OE :	Open Elective
GE :	General 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

CURRICULUM AND SYLLABI

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

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

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
THEORY									
23ECT401	Electromagnetic Fields	PC	3	1	0	4	40	60	100
23ECT402	Networks and Security	PC	3	0	0	3	40	60	100
23ECT403	Microprocessors and Microcontrollers	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ECE401	Digital Signal Processing	PC	3	0	2	4	50	50	100
23ECE402	Communication Systems	PC	3	0	2	4	50	50	100
23ECE403	Linear Integrated Circuits	PC	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						25			

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
GE	:	General 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

CURRICULUM AND SYLLABI

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

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

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
THEORY									
23ECT501	Transmission Lines and RF Systems	PC	3	1	0	4	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									
23ECE501	VLSI and Chip Design	PC	3	0	2	4	50	50	100
23ECE502	Optical and Microwave Engineering	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						23			

HS	:	Humanities and Social Sciences
BS	:	Basic Sciences
ES	:	Engineering Sciences
PC	:	Professional Core
PE	:	Professional Elective
OE	:	Open Elective
GE	:	General 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

CURRICULUM AND SYLLABI

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

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

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
THEORY									
23ECT601	Artificial Intelligence and Machine Learning	PC	3	0	0	3	40	60	100
	Professional Elective IV	PE	3	0	0	3	40	60	100
	Professional Elective V	PE	3	0	0	3	40	60	100
	Professional Elective VI	PE	3	0	0	3	40	60	100
	Open Elective-I/NCC I L1/ L3	OE	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ECE601	Embedded Systems and IoT Design	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					23				

HS : Humanities and Social Sciences
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 ES : Engineering Sciences
 PC : Professional Core
 PE : Professional Elective
 OE : Open Elective
 GE : General Elective
 EEC : Employability Enhancement Courses
 MC : Mandatory Courses
 L : Lecture
 T : Tutorial
 P : Practical
 C : Credit Point

CIA : Continuous Internal Assessment
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 TOT : Total

CURRICULUM AND SYLLABI

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

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

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
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
OE	:	Open Elective
GE	:	General 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



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B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
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						8			

HS :	Humanities and Social Sciences
BS :	Basic Sciences
ES :	Engineering Sciences
PC :	Professional Core
PE :	Professional Elective
OE :	Open Elective
GE :	General 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		CIA	ESE	TOT
23HST101	Professional English	HS	3	0	0	3	40	60	100
23HST102	தமிழர்மரபு /Heritage of Tamils	HS	1	0	0	1	40	60	100
23CYT201	Environmental Science and Sustainability	HS	3	0	0	3	40	60	100
23HSE201	English for Engineers: Theory and Practice	HS	3	0	2	4	50	50	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		CIA	ESE	TOT
23MAT101	Matrices and calculus	BS	3	1	0	4	40	60	100
23PHE103	Applied Physics for Electronics Engineering	BS	3	0	2	4	50	50	100
23CYE101	Engineering Chemistry	BS	3	0	2	4	50	50	100
23MAT202	Differential Equations and Numerical Methods	BS	3	1	0	4	40	60	100
23PHT203	Advanced Physics for Electronics Engineering	BS	3	0	0	3	40	60	100
23MAT302	Transforms and Random Processes	BS	3	1	0	4	40	60	100





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LIST OF ENGINEERING SCIENCES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23GEE101	Programming in C	ES	3	0	2	4	50	50	100
23GEL202	Engineering Drawing for Electrical and Electronics	ES	0	0	4	2	60	40	100
23GEE301	Problem Solving and Python Programming	ES	3	0	2	4	50	50	100
23EET303	Control and Instrumentation Engineering	ES	3	0	0	3	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		CIA	ESE	TOT
23GEL201	Engineering Practices Laboratory	ES	0	0	4	2	60	40	100
23EEE201	Electric Circuit Analysis	PC	3	0	2	4	50	50	100
23ECT301	Signals and Systems	PC	3	1	0	4	40	60	100
23EET303	Control and Instrumentation Engineering	PC	3	0	0	3	40	60	100
23ECE301	Electronic Devices and Circuits	PC	3	0	2	4	50	50	100
23ECE302	Digital Systems Design	PC	3	0	2	4	50	50	100
23ECT401	Electromagnetic Fields	PC	3	1	0	4	40	60	100
23ECT402	Networks and Security	PC	3	0	0	3	40	60	100
23ECT403	Microprocessors and Microcontrollers	PC	3	0	0	3	40	60	100
23ECE401	Digital Signal Processing	PC	3	0	2	4	50	50	100
23ECE402	Communication Systems	PC	3	0	2	4	50	50	100
23ECE403	Linear Integrated Circuits	PC	3	0	2	4	50	50	100
23ECT501	Transmission Lines and RF Systems	PC	3	1	0	4	40	60	100



23ECE501	VLSI and Chip Design	PC	3	0	2	4	50	50	100
23ECE502	Optical And Microwave Engineering	PC	3	0	2	4	50	50	100
23ECT601	Artificial Intelligence and Machine Learning	PC	3	0	0	3	40	60	100
23ECE601	Embedded Systems and IoT Design	PC	3	0	2	4	50	50	100

LIST OF PROFESSIONAL ELECTIVE COURSES

Professional Elective I

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23ECP501	Wide Band gap Devices	PE	3	0	0	3	40	60	100
23ECP502	Validation and Testing Technology	PE	3	0	0	3	40	60	100
23ECP503	Low Power IC Design	PE	3	0	0	3	40	60	100
23ECP504	VLSI Testing and Design for Testability	PE	3	0	0	3	40	60	100
23ECP505	Mixed Signal IC Design Testing	PE	3	0	0	3	40	60	100
23ECP506	Analog IC Design	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		CIA	ESE	TOT
23ECP507	Advanced Digital Signal Processing	PE	3	0	0	3	40	60	100
23ECP508	Image Processing	PE	3	0	0	3	40	60	100
23ECP509	Speech Processing	PE	3	0	0	3	40	60	100
23ECP510	Software Defined Radio	PE	3	0	0	3	40	60	100
23ECP511	DSP Architecture and Programming	PE	3	0	0	3	40	60	100



23ECP512	Computer Vision	PE	3	0	0	3	40	60	100
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Professional Elective III

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23ECP513	Wearable Devices	PE	3	0	0	3	40	60	100
23ECP514	Medical Electronics	PE	3	0	0	3	40	60	100
23ECP515	Therapeutic Equipment	PE	3	0	0	3	40	60	100
23ECP516	Medical Imaging Systems	PE	3	0	0	3	40	60	100
23ECP517	Brain Computer Interface and Applications	PE	3	0	0	3	40	60	100
23ECP518	Body Area Networks	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		CIA	ESE	TOT
23ECP601	RF Transceivers	PE	3	0	0	3	40	60	100
23ECP602	Signal Integrity	PE	3	0	0	3	40	60	100
23ECP603	Antenna and wave propagation	PE	3	0	0	3	40	60	100
23ECP604	MICs and RF System Design	PE	3	0	0	3	40	60	100
23ECP605	EMI/EMC Pre Compliance Testing	PE	3	0	0	3	40	60	100
23ECP606	RFID System Design and Testing	PE	3	0	0	3	40	60	100





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Professional Elective V

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23ECP607	Rocketry and Space Mechanics	PE	3	0	0	3	40	60	100
23ECP608	Wireless Sensor Network Design	PE	3	0	0	3	40	60	100
23ECP609	Industrial IoT 4.0	PE	3	0	0	3	40	60	100
23ECP610	Fundamentals of Nanoelectronics	PE	3	0	0	3	40	60	100
23ECP611	Underwater Communication	PE	3	0	0	3	40	60	100
23ECP612	Ocean Acoustics	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		CIA	ESE	TOT
23ECP613	Wireless Broad Band Networks	PE	3	0	0	3	40	60	100
23ECP614	4G/5G Communication Networks	PE	3	0	0	3	40	60	100
23ECP615	Software Defined Networks	PE	3	0	0	3	40	60	100
23ECP616	Massive MIMO Networks	PE	3	0	0	3	40	60	100
23ECP617	Advanced Wireless Communication Techniques	PE	3	0	0	3	40	60	100
23ECP618	Satellite Communication	PE	3	0	0	3	40	60	100





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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		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





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OPEN ELECTIVES II

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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





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OPEN ELECTIVES III

Offered by the Departments	Course Code / Course Name	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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





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GENERAL ELECTIVES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		CIA	ESE	TOT
23NCCL01	NCC AIRFORCE LEVEL1	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		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





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LIST OF EMPLOYABILITY ENHANCEMENT COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		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		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		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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SCHEME

Credit Summary



CREDIT SUMMARY

B.E. - ELECTRONICS AND COMMUNICATION ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
HS	4	8	-	-	-	-	3	-	12
BS	10	9	4	-	-	-	-	-	28
ES	4	2	7	-	-	-	-	-	10
PC	2	4	12	22	12	7	-	-	60
PE	-	-	-	-	9	9	-	-	18
OE	-	-	-	-	-	3	6	-	9
GE	-	-	-	-	-	-	3	-	3
EEC	1	2	1	3	2	4	4	8	25
MC	0	0	-	-	0	0	-	-	0
Total	21	25	24	25	23	23	16	8	165





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SCHEME FOR SYLLABI

B.E. –Electronics and Communication Engineering



23HST101

SEMESTER I

PROFESSIONAL ENGLISH

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

L T P C

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 Undergraduate 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	PSO1	PSO2
1	1	-	-	-	1	-	-	2	3	-	2	-	-
2	1	-	-	-	1	-	-	2	3	-	2	-	-
3	-	1	2	-	1	-	-	2	3	1	2	-	-
4	-	-	1	-	-	-	-	2	3	2	2	-	-
5	1	1	-	2	1	-	-	1	3	-	2	-	-
AVG	1	1	1.5	2	1	-	-	1.8	3	1.5	2	-	-

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


Chairman - BoS



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23MAT101

MATRICES AND CALCULUS

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

L	T	P	C
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, the 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 EXPERIMENTS

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, Fourty Third Edition, New Delhi, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, Seventh Edition, New Delhi, 2015.

REFERENCES

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

23PHE103

APPLIED PHYSICS FOR ELECTRONICS ENGINEERING

L T P C

(Common to ECE, EEE & Medical Electronics)

3 0 2 4

OBJECTIVES

- To impart knowledge of different crystal lattices and crystal structures.
- To introduce the fundamental principles of lasers and their general scientific and engineering applications.
- To provide an understanding of the principles of optical fiber and its engineering applications.
- To explain the fundamentals and industrial applications of acoustics and ultrasonics.
- To enable students to understand the principles of quantum mechanics and Schrödinger's wave equation for analyzing complex physical phenomena.
- To analyze the engineering physics that may be used to calculate thermal properties, substance characteristics, optics, acoustics, and ultrasonic's.

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 PHOTONICS

9

Spontaneous and Stimulated Emission- Population Inversion-Source of excitation- active medium, optical resonator - Derivation of Einstein's A and B co-efficient – Principle and Working of He Ne Laser - Direct Band gap and Indirect Bandgap Semiconductors - Semiconductor Diode Laser (Homo junction & hetero junction) - Applications of Lasers in Science, Engineering and Medicine - Digital Laser Material Processing Technology.

UNIT III FIBRE OPTICS

9

Principle and Propagation light in Optical Fibres- Derivation of Numerical Aperture and Acceptance angle - Classification of Optical Fibres - Fibre optic sensors. (Pressure, Temperature Sensors)-Local area Network (qualitative) -Advantages & Application of Optical Fibre: Fibre Optic Communication System, Medical Endoscope

UNIT IV 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 ultrasonic's - Magnetostriction and Piezoelectric methods - Non Destructive Testing: Pulse Echo System, through Transmission and Reflection modes.

UNIT V QUANTUM PHYSICS

9

Black Body Radiation – Planck's Theory (Derivation) – Electron Diffraction – Wave function and its Physical Significance – Schrödinger's Wave Equations: Time Independent and Time Dependent Equation – Scanning Electron Microscope - Transmission Electron Microscope - Quantum Tunnelling & Scanning Tunnelling Electron Microscope.

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. Fibre Optics: Determination of Numerical Aperture and Acceptance angle.
4. Determination of wavelength of mercury spectrum- Spectrometer.
5. Determination of velocity of ultrasonic in liquid.
6. Verification of truth tables of logic gates using IC's: (OR, AND, NOT, XOR, NOR and NAND)
7. Determination of thickness of wire - Air wedge method.
8. Determination of bandgap of a given semiconductor diode.
9. Determination of reverse bias characteristics of the photodiode. (Virtual)
10. Compact disc- Determination of width of the groove using laser. (Virtual)

TOTAL: 45 + 15 = 60 PERIODS

OUTCOMES

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

- Apply crystallographic concepts to examine the structure of crystalline solids.
- Explain the principles of lasers and it's their applications.
- Explain the principles of optical fiber and its applications.
- 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.
- Relate elasticity, optics, and semiconductor physics in engineering applications.

TEXT BOOKS

1. P.Mani, "Engineering Physics Practicals", Dhanam Publications, 2019.
2. Rajendiran V, "Engineering Physics" Tata McGraw Hill, 2017
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, "Concepts of Modern Physics", McGrawHill (Indian Edition), 2017

REFERENCES

1. Avadhanulu M.N & Kshirsagar P.G "Text Book of Engineering Physics". S.Chand, 2016.
2. Wahab, M.A. "Solid State Physics: Structure and Properties of Materials" Narosa Publishing House, 2019
3. K.Thyagarajan and A.Ghatak. "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019

E-RESOURCES

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	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	-	-	-	-	-	-	-	-	-
AVG	3	3	1	1	-	-	-	-	-	-	-	-	-

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


Chairman - BoS

23CYE101

ENGINEERING CHEMISTRY

(Common to CSE, EEE, ECE, CSE (CS), MDE, AIDS, IT, PT)

L T P C

3 0 2 4

OBJECTIVES

- To introduce the characteristics of water and water treatment methods for industrial applications.
- To familiarize students with the types, properties, and applications of polymers and related materials.
- To employ the principles of phase rule, alloy formation, and heat treatment methods.
- To discuss the synthesis, characterization, and applications of nanomaterials.
- To apply electrochemical principles to understand corrosion mechanisms 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 POLYMER CHEMISTRY

9

Introduction - Classification of polymers – Natural and Synthetic; Thermoplastic and Thermosetting plastic. Functionality – Degree of polymerization. Types of polymerization: Addition Condensation and Copolymerization, Property of polymer: Glass transition temperature, Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers – Types – Vulcanization of rubber – Plastics – Moulding constituents of plastics – Moulding of plastics – Compression and injection - Biodegradable polymers- Conducting polymers.

UNIT III PHASE RULE AND ALLOYS

9

Phase rule - Explanation of terms involved – One component system – Water system – Condensed phase rule- Simple eutectic systems (Lead – Silver system only). Alloys: Introduction – Definition- Properties of alloys- Significance of alloying, functions and effect of alloying elements - Ferrous alloys – Nichrome and stainless steel – Heat treatment of steel, non-ferrous alloy – Brass.

UNIT IV CHEMISTRY OF NANO MATERIALS

9

Nano chemistry – Basics (Surface area to volume ratio - Distinction between molecules, nanoparticles and bulk materials- Characterization of nanomaterials using EDX and HR-TEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition -Applications of nanomaterials (Nano products of today).

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.

TOTAL:45 PERIODS



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. Conduct metric Precipitation Titration using BaCl_2 and Na_2SO_4 .
8. Conduct metric 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 = 60 PERIODS

OUTCOMES

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

- Explain the quality parameters of water and suitable methods for removing impurities for domestic and industrial applications.
- Compare various types of polymers based on their polymerization processes, properties, and engineering applications.
- Apply the principles of phase rule to explain alloy formation and its engineering applications.
- Employ the basic concepts of nano chemistry in engineering applications.
- Analyze the causes of corrosion and recommend suitable prevention and control methods

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Seventeenth Edition, Dhanpet Rai Publishing Company (P) Ltd. New Delhi, 2015.
2. Viswanathan B, "Nanomaterials" First Edition, Alpha Science International Ltd, 2009.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", Tenth Edition, S. Chand & Company Ltd, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.

E-RESOURCES



1. <https://nptel.ac.in/courses/104105084>
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	PSO1	PSO2
1	2	1	3	-	1	-	3	-	-	-	-	-	-
2	1	2	2	2	1	1	-	2	1	2	1	-	-
3	3	3	3	2	2	2	1	1	2	1	1	-	-
4	2	2	2	1	2	2	1	-	1	1	1	-	-
5	3	2	3	2	3	2	1	2	1	-	2	-	-
AVG	2.2	2.0	2.6	1.75	1.80	1.75	1.5	1.6	1.25	1.33	1.25	-	-

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


Chairman - BoS



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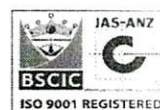
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23HST102

HERITAGE OF TAMILS (Common to All Branches)

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 Thinaï in Tamils.
- To realize the contribution of Tamils in Indian freedom struggle.

UNIT I LANGUAGE AND 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, Kaniyan Koothu, 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





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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 Thina 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 - மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடுபாடநூல்மற்றும் கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருளை - 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	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





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23HST102

தமிழர் மரபு

(அனைத்து துறைகளுக்கும் பொதுவானது)

L T P C

1 0 0 1

நோக்கங்கள்:

மாணவர்கள் கண்டிப்பாக அறியவேண்டுவன:

- செம்மொழியான தமிழ்மொழியின் விரிவான இலக்கியத்தைப் பற்றி அறிதல்.
- பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை உள்ள கலைகளை பகுப்பாய்வு செய்தல்.
- நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகளைப் புரிந்து கொள்ளுதல்.
- தமிழர்களின் திணைக்கோட்பாடுகளைச் செயல்படுத்துதல்.
- இந்திய விடுதலைப் போராட்டத்திற்கும் பண்பாட்டிற்கும் தமிழர்களின் பங்களிப்பை உணருதல்.

அலகு 1 மொழி மற்றும் இலக்கியம்

3

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் -சங்க இலக்கியத்தின் சமயச்சார் பற்றதன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள்- தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம்- பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் -தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை

3

நடுகல் முதல் நவீன சிற்பங்கள்வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடு மண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக்கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூகபொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.





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அலகு IV தமிழர்களின் திணைக்கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்கஇலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் -சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில் சித்தமருத்துவத்தின் பங்கு - கல்வெட்டுகள், கையெழுத்துப்படிக்கள் - தமிழ்ப்புத்தகங்களின் அச்சுவரலாறு.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின் முடிவில், மாணவர்கள் அறிந்து கொள்வன:

- தமிழ்மொழியின் செம்மொழி தன்மையையும் சங்க இலக்கியத்தின் முக்கியத்துவத்தையும் உணர்வார்கள்.
- தமிழர்களின் சிற்ப, ஓவிய, இசை மரபுகளை புரிந்து கொள்வார்கள்.
- நாட்டுப்புறக்கலைகளையும் வீர விளையாட்டுகளையும் வகைப்படுத்துவார்கள்.
- தமிழர்களின் திணைக்கோட்பாடுகளும் சங்ககாலவர்த்தகமும் புரிந்து கொள்வார்கள்.
- இந்திய விடுதலைப் போராட்டம், சுயமரியாதை இயக்கம், சித்தமருத்துவம் ஆகியவற்றில் தமிழர்களின் பங்களிப்பை விளக்குவார்கள்.

உரை மற்றும் குறிப்புத்தகங்கள்:

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 நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருறை - ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு).
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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.)





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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

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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





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23GEE101

PROGRAMMING IN C (Lab Embedded Theory Course)

L T P C
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.





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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 constructs.
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





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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", Pearson Education, Second Edition, 2006.

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., First Edition, 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/> (File operations)





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Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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	2.3	2.3	2.0	1.4	2.5	-	1	1	1.3	1	1.7	2.5	2.2

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


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23EEEC101

SOFT SKILLS & LIFE SKILLS

L T P C
1 0 0 1

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

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.





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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-RESOURCES

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	PSO1	PSO2
1	1	1	0	0	0	2	2	3	2	1	0	-	-
2	1	3	1	1	0	1	0	2	3	3	1	-	-
3	0	1	0	0	0	1	0	3	3	3	1	-	-
4	2	2	1	1	3	1	0	2	3	3	3	-	-
5	1	1	1	0	0	2	0	3	3	3	3	-	-
AVG	1	1.6	0.6	0.4	0.6	1.4	0.4	2.6	2.8	2.6	1.6	-	-

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


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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.





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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

23MAT202

DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS

[Common to Civil, EEE, ECE and MDE]

L	T	P	C
3	1	0	4

OBJECTIVES

- To explore techniques for solving ordinary differential equations and recurrence relations.
- To compose the purpose of using Laplace transforms to create a new domain in which problems can be handled more easily.
- 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 ORDINARY DIFFERENTIAL EQUATIONS AND RECURRENCE RELATIONS

9+3

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Legendre's linear equations – Simultaneous linear equations with constant coefficients – Recurrence relations: Solving linear homogeneous recurrence relations with constant coefficients.

UNIT II LAPLACE TRANSFORMS

9+3

Definition – Conditions for existence – Transforms of elementary functions – Properties of Laplace transforms – Transform of Periodic functions – Transforms of derivatives and integrals – Multiplication by 't' and division by 't' – Evaluation of integrals by Laplace transforms – Inverse transforms – Convolution theorem – Application to solution of linear second order ordinary differential equations with constant coefficients.

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 with equal intervals: Newton's forward interpolation formula – Newton's backward interpolation formula – Interpolation with unequal intervals: Lagrange's interpolation formula – Divided differences – Newton's divided difference formula – Numerical integration: Trapezoidal rule – Simpson's one-third rule – Numerical double integration by Trapezoidal rule.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

9+3

Taylor's series method – Euler's method – Modified Euler's method – Runge-Kutta method – Predictor-corrector methods: Milne's method – Adams-Bashforth method.



OUTCOMES

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

- Apply appropriate techniques to solve ordinary differential equations and recurrence relations.
- Solve engineering problems using the concept of Laplace transforms.
- 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 EXPERIMENTS

1. Solving ordinary differential equations.
2. Compute homogeneous recurrence relations.
3. Calculate Laplace Transform of simple functions.
4. Calculate Inverse Laplace transform of a given function.
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., "Higher Engineering Mathematics", Khanna Publishers, Fourty Fourth Edition, 2022.
2. Grewal, B.S., "Numerical Methods in Engineering and Science", Khanna Publishers, Eleventh Edition, 2023.

REFERENCES

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Tenth Edition, 2016.
2. Burden, R.L and Faires, J.D, "Numerical Analysis", Cengage Learning, Nineth Edition, 2016.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/111/105/111105121/> (Ordinary differential equations)
2. <https://nptel.ac.in/courses/111106139> (Laplace transforms)
3. <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	PSO1	PSO2
1	3	3	2	2	2	-	-	-	-	-	2	-	-
2	3	3	2	2	2	-	-	-	-	-	2	-	-
3	3	2	2	1	2	-	-	-	-	-	2	-	-
4	3	2	2	1	2	-	-	-	-	-	2	-	-
5	3	2	2	1	2	-	-	-	-	-	2	-	-
AVG	3	2.4	2	1.4	2	-	-	-	-	-	2	-	-

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

[Signature]
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23PHT203

ADVANCED PHYSICS FOR ELECTRONICS ENGINEERING
(Common to ECE, EEE & Medical Electronics)

L T P C
3 0 0 3

OBJECTIVES

- To explain the fundamental conduction mechanisms in conducting and dielectric materials.
- To provide knowledge on semiconductor physics and the principles of plastic electronics and their technological applications.
- To teach the basic concepts and properties of magnetic and superconducting materials.
- To introduce the principles of spintronics and nanoelectronic devices.
- To impart understanding of the fundamentals of biophotonics and biomaterials for biomedical applications.

UNIT I CONDUCTING MATERIALS & DIELECTRIC MATERIALS

9

Conductors – Classical Free Electron Theory of Metals – Electrical and Thermal Conductivity – Wiedemann – Franz law, Lorentz number – Draw backs of Classical Theory. Dielectric Materials: Electrical Susceptibility – Dielectric constant – Electronic, Ionic, Orientation and Space Charge Polarization- Internal field and Clausius-Mosotti Relation.

UNIT II SEMICONDUCTING MATERIALS & PLASTIC ELECTRONICS

9

Elemental and Compound Semiconductors – Intrinsic Semiconductor & Extrinsic semiconductor – Carrier concentration derivation in Intrinsic Semiconductor - Hall effect and applications. Plastic Electronics: Introduction - Materials for Plastic Electronics - Conducting Polymers and Organic Semiconductors - Fabrication Techniques - Organic Light Emitting Diodes (OLEDs) - Organic Field Effect Transistors (OFETs).

UNIT III MAGNETIC & SUPERCONDUCTING MATERIALS

9

Electron theory of magnetism; Dia, Para, Ferromagnetism and their Properties- Domain theory of Ferromagnetism – Hard and Soft magnetic Materials - Ferrites - Superconductivity: Properties – Type I and Type II Superconductors – BCS theory of superconductivity - High T_c Superconductors – General applications of Superconductors –Cryotron and Magnetic levitation.

UNIT IV SPINTRONICS & NANO ELECTRONIC DEVICES

9

Introduction- Quantum confinement- Quantum well, Quantum Wire and Quantum Dot structure – Tunnelling: Single Electron Phenomena and Single Electron Transistor (SET) - Spintronics – Quantum Dot Laser- Quantum Bits (qubits)- Quantum Computing- Carbon Nano Tubes (CNT) structure, Properties and applications. Concepts of Molecular Transistor & Graphene Transistor – Carbon nano tube transistor (qualitative) - Applications of Nanodevices and Nanosensors.

UNIT V BIOPHOTONICS & BIOMATERIALS

9

Bio Photonics: Basic principles of light - Reflection - Refraction - Absorption - Polarization - Interference – Coherence- Principles of Optical biosensing - Immobilization of Bio-recognition elements-Types of Optical Biosensor

Bio Materials: Definition and classification of Bio-Material- Viscoelasticity and biomaterial performance- Stainless Steel Alloys and its applications- Biopolymers and its Applications - Shape Memory Alloy.

OUTCOMES

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

- Explain the conduction mechanisms in conducting and dielectric materials.
- Describe the fundamentals of semiconductor physics and plastic electronics and relate them to electronic device applications.
- Explain the properties and applications of magnetic and superconducting materials.
- Describe the working principles of spintronic and nanoelectronic devices.
- Explain the basic principles and applications of biophotonics and biomaterials.

TEXT BOOK

1. Rajendran V, "Engineering Physics", Tata McGraw Hill Publications, 2015.
2. Murugesan R, Kiruthiga Sivaprasath E, "Modern Physics", S.Chand, Tenth Edition, 2019.
3. Gupta and Kumar, "Solid State Physics", K. Nath & Co, 2018.

REFERENCES

1. Sujata V, Bhatt, "Biomaterials", Seventh Edition, Narosa Publishing House, 2016.
2. Avadhanulu M.N, Kshirsagar P.G, "Text Book of Engineering Physics", S.Chand, 2015.
3. Charles Kittel, "Introduction to Solid State Physics", Wiley, 2019.

E – RESOURCES

1. <https://archive.nptel.ac.in/courses/115/101/115101092/>
2. <https://nptel.ac.in/courses/108104113>

Mapping of COs-POs & PSOs

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

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


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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 (d) 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.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of the course, the 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	PSO1	PSO2
1	2	2	3	-	-	3	3	-	-	2	1	-	-
2	2	2	3	2	3	3	3	-	-	3	3	-	-
3	2	1	3	2	2	3	3	-	2	3	3	-	-
4	2	1	3	2	3	3	3	2	3	2	2	-	-
5	2	1	3	2	3	3	3	2	3	2	2	-	-
AVG	2	1.4	3	2	2.2	3	3	2	2.6	2.4	2.2	-	-

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


Chairman - BoS

23HST202

TAMILS AND TECHNOLOGY
(Common to All Branches)

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 beads - 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:தமிழ்நாடுபாடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் - முனைவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
- 3.கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருளை -ஆற்றங்கரைநாகரீகம். (தொல்லியல்துறைவெளியீடு).
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	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

LTPC

(அனைத்து துறைகளுக்கும் பொதுவானது)

1001

நோக்கம்:

மாணவர்கள் கண்டிப்பாக அறியவேண்டுவன:

- நெசவு மற்றும் பீங்கான் தொழில்நுட்பம் பற்றிய அறிவைப் பெறுதல்.
- வடிவமைப்பு மற்றும் கட்டுமான தொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தி தொழில் நுட்பத்தைப்பகுப்பாய்வுசெய்தல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத் தொழில் நுட்பத்தைப் பயன்படுத்துதல்.
- அறிவியல்மற்றும்அறிவியல்தமிழ்மற்றும்தமிழ்கணிப்பொறிதொடர்பான அறிவைநினைவில்கொள்ளுதல்.

அலகு 1 நெசவு மற்றும் பாணைதொழில்நுட்பம்

3

சங்ககாலத்தில்நெசவுத்தொழில் - பாணைதொழில்நுட்பம் - கருப்பு, சிவப்புபாண்டங்கள் - பாண்டுகளில்கீறல்குறியீடுகள்.

அலகு 2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்ககாலத்தில்வடிவமைப்பும்மற்றும்கட்டுமானங்கள்&சங்ககாலத்தில்வீட்டுப் பொருட்களில்வடிவமைப்பு- சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரம் சிற்பங்கள், கோவில்களும் - சோழர்காலத்தாபெருங்கோயில்கள்மற்றும்பிறவழிபாட்டுத்தலங்கள்நாயக்கர் காலகோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரைமீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர்மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக்கலை.

அலகு 3 உற்பத்தித் தொழில்நுட்பம்

3

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்பு தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடிகள் - மணிஉருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண்மணிகள் - சங்கு மணிகள் - எலும்பு துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசன தொழில்நுட்பம்

3

அணை, குளங்கள், மடகு - சோழர் கால குமுளி தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார்

அறிவு - மீன்வளம் - முத்து மற்றும் முத்துகுளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார்ச்சமுகம்.

அலகு 5 அறிவியல் தமிழ் மற்றும் கணித்தமிழ்

3

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ்நூல்களை மின்பதிப்பு செய்தல் - தமிழ்மென் பொருட்கள் உருவாக்கம் - தமிழ்இணையக் கல்விக்கழகம் - தமிழ் மின்நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

முடிவுகள்:

பாடத்தின்முடிவில், மாணவர்கள்அறிந்து கொள்வன:

- பீங்கான் மற்றும் நெசவு தொழில் நுட்பத்தைப் புரிந்து கொள்ளுதல்.
- புதிய வடிவமைப்பு மற்றும் கட்டுமானதொழில் நுட்பத்தை உருவாக்குதல்.
- உற்பத்தித் தொழில் நுட்பத்தை அடையாளம் காணுதல்.
- விவசாயம் மற்றும் நீர்ப்பாசனத்தைப் புரிந்து கொள்ளுதல்.
- அறிவியல் தமிழ் மற்றும் தமிழ் கணிப்பொறி தொடர்பான அறிவை பெறுதல்.

உரை மற்றும் குறிப்பு புத்தகங்கள்:

- 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 (தொல்லியல்துறைவெளியீடு)
4. பொருறை -ஆற்றங்கரை நாகரீகம். (தொல்லியல்துறை 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).
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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)
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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	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

23HSE201

ENGLISH FOR ENGINEERS: THEORY AND PRACTICE
(Common to all B.E. & B.Tech. Branches)

L T P C
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 II", Maven Learning Private Limited, 2012.
2. Joshi, Manmohan, "Soft Skills", First Edition, Bookboon, 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", Oxford University Press, UK, 2013.

E-RESOURCES

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

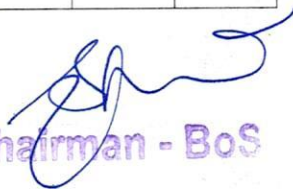
EXTENSIVE READING

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	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	3	-	2	-	-
AVG	1	2	-	2	1	2	1.5	2.3	3	2	1.6	-	-

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


Chairman - BoS

23EEE201

ELECTRIC CIRCUIT ANALYSIS

(Lab Embedded Theory Course)

LT P C

3 0 2 4

OBJECTIVES

- To instruct basic concepts, basic laws and methods of analysis of DC and AC circuits.
- To inculcate the various methods of circuit analysis using network theorems.
- To impart knowledge in resonance and coupled circuits.
- To develop the understanding of steady state and transient response of RLC circuits.
- To familiarize the balanced and unbalanced three phase circuits.
- To enhance the practical skills providing hands-on experience in applying network theorems and analyzing transient circuits.

UNIT I BASIC CIRCUIT ANALYSIS

9

Introduction DC and AC Circuits - Basic circuit elements - Ohm's Law - Kirchhoff's laws - Voltage and Current division - Source Transformation - Resistors in series and parallel circuits - Star-delta transformation - Mesh and nodal analysis for DC Circuits

UNIT II NETWORK THEOREMS FOR DC CIRCUITS

9

Thevenin's and Norton's Theorem - Superposition Theorem - Maximum power transfer theorem - Reciprocity Theorem

UNIT III RESONANCE AND COUPLED CIRCUITS

9

Series and parallel resonance - Frequency response - Quality factor and Bandwidth - Self and mutual inductance - Dot rule - Coefficient of coupling - Analysis of coupled circuits.

UNIT IV TRANSIENT ANALYSIS

9

Natural response - Forced response - Transient response of RL, RC and RLC circuits using Laplace transform for DC input and AC sinusoidal input.

UNIT V THREE PHASE CIRCUITS

9

Average and RMS value - Phasor diagram - Power, Power factor and Energy - Analysis of three phase star and delta connected circuits with balanced and unbalanced loads - Power and Power factor measurements.

LIST OF EXPERIMENTS

1. Simulation and Experimental verification of electrical circuit problems using Kirchhoff's voltage and current laws.
2. Simulation and Experimental verification of electrical circuit problems using Thevenin's theorem and Norton's theorem.
3. Simulation and Experimental verification of electric circuit problems using Superposition theorem.
4. Simulation and Experimental verification of electric circuit problems using Maximum Power transfer Theorem.
5. Simulation and Experimental validation of R-C electric circuit transients
6. Simulation and Experimental validation of frequency response of RLC electric circuit.
7. Simulation of three phase balanced and unbalanced star, delta networks circuits

TOTAL : 45+15 = 60 PERIODS

OUTCOMES

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

- Apply the basic concepts to solve and evaluate DC and AC electrical circuits.
- Analyze complex electric circuits by applying network theorems
- Analyze the performance of resonance and coupled circuits.
- Examine the transient response behavior of RL, RC and RLC electrical circuits.
- Examine the parameters balanced and unbalanced three phase circuits.
- Apply the circuit theorems and concepts in engineering applications.

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, New Delhi, Ninth edition, 2020.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill, Second Edition, 2019.

REFERENCES:

1. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpat Rai Publishing Co Pvt Ltd, New Delhi, Seventh Edition, 2018.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, Fifth Edition, 2021.

E-RESOURCES:

1. <https://nptel.ac.in/courses/108102042/> - (Circuit Theory)
2. <https://nptel.ac.in/courses/108104139/> - (Basic Electric Circuit)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

COURSE 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

OUTCOMES

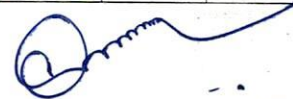
Upon completion of this course, the students will be able to:

- 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

23GEL202

ENGINEERING DRAWING FOR ELECTRICAL AND ELECTRONICS

(Common For ECE, EEE & MDE)

LT P C

0 0 4 2

OBJECTIVES

- To impart knowledge of engineering drawing concepts through multiple views of engineering components.
- To familiarize students with the projection of solids in different positions using engineering drawing principles.
- To develop the ability to prepare engineering drawings of electrical appliances.
- To familiarize students with computer-aided drafting and 3D modeling software for engineering components.
- To enhance students' knowledge of software tools used for designing human anatomy and orthopedic implant models.

LIST OF EXPERIMENTS

1. Conversion of isometric views into orthographic
2. Conversion of orthographic views into isometric
3. Projection of solids - Hexagonal pyramid.
4. Projection of solids - Square prism.
5. Draw Fluorescent lamp wiring diagram and layout.
6. Draw staircase wiring diagram and layout.
7. Design and Implementation of NOR/XOR
8. Layout diagram of CMOS inverter and CMOS NAND gate.
9. Design of Human Anatomical structures.
10. Design of orthotics model.

TOTAL: 30 PERIODS

OUTCOMES

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

- Construct multiple views of engineering components.
- Develop the projection of solids.
- Design and develop the circuit connections of an electrical appliance.
- Design, analyze and simulate electronics components using Hardware and Software.
- Create precise and detailed technical drawings, simulate designs, and create digital prototypes for Healthcare Industry.



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Mapping of COs-POs & PSOs

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

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


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23EEEC201

INDIAN LANGUAGE
(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE
(Common to all B.E. & B.Tech. Branches)

L T P C
0 0 4 2

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 वर्णमाला एवं मूलभूत व्याकरण (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 शब्दभंडार एवं व्याकरण (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 पठन एवं लेखन कौशल (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 दैनिक जीवन में हिंदी (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 साहित्य एवं पुनरावृत्ति (LITERATURE AND REVISION)

4

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

TOTAL: 30 PERIODS





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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	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	1	1	3	-	1	-	-
CO3	-	-	-	-	-	-	1	2	3	-	2	-	-
CO4	-	-	-	-	-	1	2	2	3	-	1	-	-
CO5	-	-	-	-	-	-	-	-	2	-	3	-	-
AVG	-	-	-	-	-	1.0	1.3	1.6	2.8	-	1.6	-	-

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

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23EEC201

INDIAN LANGUAGE
(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE
(Common to all B.E. & B.Tech. Branches)

L T P C
0 0 4 2

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

UNIT III 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: 30PERIODS





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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	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	-	1	-	-
CO2	-	-	-	-	-	-	1	1	3	-	1	-	-
CO3	-	-	-	-	-	1	2	2	3	-	2	-	-
CO4	-	-	-	-	-	-	1	2	3	-	2	-	-
CO5	-	-	-	-	-	1	2	2	3	-	2	-	-
AVG	-	-	-	-	-	1.0	1.5	1.7	3.0	-	1.6	-	-

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

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23EEC201

INDIAN LANGUAGE
(EXCEPT MOTHER TONGUE) / FOREIGN LANGUAGE
(Common to all B.E. & B.Tech. Branches)

L T P C
0 0 4 2

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





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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	PSO1	PSO2
CO1	-	-	-	-	1	1	-	1	2	-	-	-	-
CO2	-	-	-	-	1	2	-	2	2	-	-	-	-
CO3	-	-	-	-	2	2	1	2	3	-	1	-	-
CO4	-	-	-	-	2	2	1	3	3	-	1	-	-
CO5	-	-	-	-	1	1	1	2	3	-	1	-	-
AVG	-	-	-	-	1.4	1.6	1.0	0.2	2.6	-	1.0	-	-

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

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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





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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 Services Pvt. 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=RDQM5XI256aOq24>
2. <https://youtu.be/KE7tQf9spPg>


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23MAT302

SEMESTER III TRANSFORMS AND RANDOM PROCESSES

(Common to ECE & MDE)

L T P C

3 1 0 4

OBJECTIVES

- To introduce the basic concepts of random variables.
- To provide knowledge of one-dimensional and two-dimensional random variables.
- To explore the classification of random processes and related concepts.
- To introduce the basics of Fourier transforms and their properties.
- To compute the Z-transforms of standard functions and their properties.

UNIT I RANDOM VARIABLES

9+3

Random variables - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

UNIT II TWO – DIMENSIONAL RANDOM VARIABLES

9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES

9+3

Classification – Stationary process – Markov process – Poisson process – Discrete parameter-Markov chain – Chapman Kolmogorov equations (Statement only) – Limiting distributions.

UNIT IV 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 V 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.

TOTAL: 45+15 PERIODS

OUTCOMES

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

- Apply the concept of random variables in engineering disciplines.
- Classify the concepts of one and two dimensional random variables.
- Compute the basic concepts of random processes.
- Apply various Fourier transform techniques in physical problems of engineering.
- Solve engineering problems using the concept of Z transforms.



TEXT BOOKS

1. Grewal, B.S., "Higher Engineering Mathematics; Khanna Publishers, Fourty Third Edition, New Delhi, 2014.
2. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", Second Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

REFERENCES

1. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, First Edition, 2007.
2. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", Second Edition, John Wiley and Sons, 2002.

E-RESOURCES

1. <https://nptel.ac.in/courses/117105085> (Probability and Random Processes)
2. <https://archive.nptel.ac.in/courses/111/102/111102129/#> (Transforms)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	-	-	-	-	-	1	-	-
2	3	3	2	3	2	-	-	-	-	-	1	-	-
3	3	3	2	3	2	-	-	-	-	-	1	-	-
4	3	3	2	3	2	-	-	-	-	-	1	-	-
5	3	3	2	3	2	-	-	-	-	-	1	-	-
AVG	3.0	3.0	2.0	3.0	2.0	-	-	-	-	-	1.0	-	-

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

Chairman
Chairman - BoS

23ECT301

SIGNALS AND SYSTEMS

L T P C

3 1 0 4

OBJECTIVES

- To discuss the basic properties of signals and systems.
- To discuss about continuous time signals in the Fourier and Laplace domain.
- To explain the methods of characterization of LTI systems in time domain.
- To relate the discrete time signals in the Fourier and Z transform domain.
- To describe the concept of LTI discrete system in the Fourier and Z transform domain.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS

9+3

Standard signals - Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids—
Classification of signals – Continuous Time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals – Classification of systems - CT systems and DT systems – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS

9+3

Fourier series for periodic signals - Fourier Transform – properties - Laplace Transforms and Properties.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

9+3

Impulse response - convolution integrals - Differential Equation - Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS

9+3

Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

9+3

Impulse response–Difference equations–Convolution sum - Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems - DT systems connected in series and parallel.

TOTAL: 60 PERIODS

OUTCOMES

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

- Obtain in depth knowledge about the classification of signals and systems.
- Analyze the frequency components present in a deterministic signal.
- Design the continuous LTI systems in the time domain and frequency domain.
- Analyze the properties of Z transform and Discrete Time Fourier Transform.
- Design discrete LTI systems using Z transform and Discrete Time Fourier Transform.



TEXT BOOKS

1. Oppenheim, Willsky and Hamid, "Signals and Systems", Pearson Education, New Delhi, Second Edition, 2017.
2. Simon Haykin, Barry Van Veen, "Signals and Systems", Wiley, Second Edition, 2018.

REFERENCES

1. B. P. Lathi, "Principles of Linear Systems and Signals", Oxford, Second Edition, 2009.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/104/117104074/>-(Signals and Systems)
2. <https://archive.nptel.ac.in/courses/108/104/108104100/>-(Principles of Signals and Systems)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	-	3	-	3	2	-	-	-	-	3	3	-
2	3	-	3	-	-	2	-	-	-	-	3	3	1
3	3	3	-	-	3	2	-	-	-	-	3	3	1
4	3	3	-	-	3	2	-	-	-	-	3	3	-
5	3	3	-	3	3	2	-	-	-	-	3	3	1
6	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG	3.0	3.0	3.0	3.0	3.0	2.0	-	-	-	-	3.0	3.0	1.0

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


Chairman - BoS

23EET303

CONTROL AND INSTRUMENTATION ENGINEERING

L T P C
3 0 0 3

OBJECTIVES

- To impart the fundamental concepts of control systems and mathematical modeling of the system.
- To explain the time response of systems and the steady state error.
- To inculcate the frequency domain specifications using plots and stability analysis of control systems.
- To discuss about the various operating principle of instruments in AC and DC measurements.
- To summarize about the different bridges and digital storage devices.

UNIT I MODELLING OF CONTROL SYSTEMS

9

Introduction - Open Loop and Closed Loop Systems - Mathematical Model of Control Systems - Transfer Functions - Mechanical Translational Systems - Mechanical rotational Systems - Block Diagram Algebra - Signal Flow Graph.

UNIT II TIME DOMAIN ANALYSIS

9

Transient and steady state response analysis. Steady state error & error constants. Dynamic error and dynamic error coefficient-Effects of pole and zero addition on transient and steady state response- Absolute stability and relative stability- Routh's and Hurwitz criterion of stability, Root locus method of analysis.

UNIT III FREQUENCY RESPONSE AND STATE SPACE MODELLING

9

Frequency Response - Frequency Domain Specifications - Resonant Peak – Resonant Frequency - Bandwidth- Cut-Off Rate - Gain Margin and Phase Margin - Frequency Response Plots - Bode Plot- Polar Plot – Correlation between time and Frequency response- Concepts of state, state variable and state model, controllability and observability.

UNIT IV ELECTRICAL AND ELECTRONIC INSTRUMENTS

9

Functional elements of an instrument -classification – Example of a generalized measurement - Static and dynamic characteristics - Standards and calibration -Principle and operation of analog voltmeters and ammeters: Moving iron: Attraction and repulsion type instruments, Moving coil instruments; PMMC, Dynamometer type, torque equation-Smart meters.

UNIT V BRIDGES, DIGITAL INSTRUMENTS AND DISPLAY DEVICES

9

DC bridges: Wheatstone bridge, Kelvin's double bridge, Megger - AC bridges: Maxwell's, Anderson, Schering- Digital voltmeter: Ramp, Integrating and Successive approximation - Digital multi-meter - CRT display, dot matrix display, LED and LCD display - Digital energy meter - Digital Storage Oscilloscope (DSO) – Digital printers and plotters.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Design transfer function models to analyze physical systems.
- Implement the transient and steady state behavior of systems subjected to standard test signals.
- Analyze the frequency domain and stability of the linear system in concepts of various system stability criterions.
- Describe the concepts of electrical and electronics instruments.
- Determine the different AC-DC bridges and digital meters & display devices.

TEXT BOOKS

1. J.Nagrath and M.Gopal, "Control Systems Engineering", Sixth Edition, New Age International (P) Ltd, Publishers, 2017.
2. A.K.Sawhney, "A Course in Electrical & Electronic Measurements and Instrumentation", Dhanpat Rai and Co, Second Edition, 2021.

REFERENCES

1. A.Nagoorkani, "Control Systems Engineering", Third Edition, RBA Publications, 2021.
2. R.K.Rajput, "Electrical Measurements and Measuring Instruments", S.Chand and Company Pvt. Ltd, Fourth Edition, 2016.

E - RESOURCES

1. <https://nptel.ac.in/courses/108/106/108106098/> (Control Engineering)
2. <https://nptel.ac.in/courses/108/105/108105153/> (Electrical Measurements and Electronic Instrument)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	-	-	1	-	2	-	2	3	2
2	3	3	3	3	-	-	1	-	2	-	2	3	2
3	3	3	3	3	-	-	1	-	2	-	2	3	2
4	3	3	3	3	-	-	1	-	2	-	2	3	2
5	3	3	3	3	-	-	1	-	2	-	2	3	2
AVG	3.0	3.0	3.0	3.0	-	-	1.0	-	2.0	-	2.0	3.0	2.0

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

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23ECE301

ELECTRONIC DEVICES AND CIRCUITS (Lab Embedded Theory Course)

L T P C
3 0 2 4

OBJECTIVES

- To introduce the various types of semiconductor devices and circuits.
- To describe about the frequency response of small signal amplifiers.
- To explain the principles of multistage amplifiers and differential amplifier.
- To discuss the characteristics of feedback amplifiers.
- To explain the operation of power amplifiers and DC/DC converters.
- To develop the operational characteristics of semiconductor devices and amplifiers.

UNIT I SEMICONDUCTOR DEVICES

9

PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, diffusion and transition capacitance - Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator.

UNIT II AMPLIFIERS

9

Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Gain and frequency response – MOSFET small signal model – Analysis of CS, CG and Source follower – Gain and frequency response- High frequency analysis.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

9

Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – MOSFET input stages – tuned amplifiers – Gain and frequency response.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS

9

Advantages of negative feedback – Voltage / Current, Series, Shunt feedback Amplifiers – positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS

9

Power amplifiers - Class A - Class B - Class AB - Class C - Power MOSFET - Temperature Effect - Class AB Power amplifier using MOSFET – DC/DC convertors – Buck, Boost, Buck-Boost operations.

LIST OF EXPERIMENTS

1. Characteristics of PN Junction Diode and Zener diode.
2. Full Wave Rectifier with Filters.
3. Design of Zener diode Regulator.
4. Common Emitter input-output Characteristics.
5. MOSFET Drain current and Transfer Characteristics.
6. Frequency response of CE and CS amplifiers.
7. Frequency response of CB and CC amplifiers.
8. Frequency response of Cascade Amplifier



9. CMRR measurement of Differential Amplifier
10. Class A Transformer Coupled Power Amplifier.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Analyze the structure and working operation of basic semiconductor devices.
- Design frequency response of BJT and MOSFET amplifiers.
- Analyze multistage amplifiers and instrumentation amplifiers.
- Determine operational parameters of feedback amplifiers and oscillator principles.
- Understand the operational principles of power amplifiers and converters.
- Analyze the characteristics of semiconductor circuits and amplifier.

TEXT BOOKS

1. David A. Bell, "Electronic Devices and Circuits", Oxford Higher Education press, Fifth Edition, 2010.
2. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", Pearson Education / PHI, Thirteenth Edition, 2013.

REFERENCES

1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, Fourth Edition, 2017.
2. D.Schilling and C.Belove, "Electronic Circuits", McGraw Hill, Fourth Edition, 2016.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105158/>-(Analog Electronic Circuits)
2. <https://nptel.ac.in/courses/117/103/117103063/>-(Basic Electronics)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	1	-	-	-	-	1	2	1
2	3	2	3	3	2	2	-	-	-	-	1	2	1
3	3	3	3	2	1	2	-	-	-	-	1	2	1
4	3	3	3	3	2	2	-	-	-	-	1	2	1
5	3	2	3	2	2	1	-	-	-	-	1	2	1
6	2	2	2	3	2	1	-	-	-	-	1	2	1
AVG	3.0	3.0	3.0	3.0	2.0	2.0	-	-	-	-	1.0	2.0	1.0

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


Chairman - BoS

23ECE302

DIGITAL SYSTEMS DESIGN
(Lab Embedded Theory Course)

L T P C
3 0 2 4

OBJECTIVES

- To introduce the fundamentals of digital circuits and simplification methods.
- To discuss about various combinational digital circuits using logic gates.
- To examine the design procedures for synchronous sequential circuits.
- To describe the design procedures for asynchronous sequential circuits.
- To gain knowledge on semiconductor memories and related technology.
- To enable the students implement the basic digital logic circuits and converters.

UNIT I BASIC CONCEPTS

9

Review of number systems-representation-conversions, Review of Boolean algebra- theorems, sum of product and product of sum simplification, canonical forms min term and max term, Simplification of Boolean expressions-Karnaugh map, completely and incompletely specified functions, Implementation of Boolean expressions using universal gates.

UNIT II COMBINATIONAL LOGIC CIRCUITS

9

Problem formulation and design of combinational circuits, Half and Full Adders, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Code-Converters, Magnitude Comparator, Decoder, Encoder, Mux/Demux, Case study: Parity Generator/Checker, Seven Segment display decoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS

9

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Analysis and design of synchronous sequential circuits – Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS

9

Stable and Unstable states, output specifications, cycles and races, Analysis and design of asynchronous sequential circuits state reduction, race free assignments, Hazards, Essential Hazards, Design of Hazard free circuits.

UNIT V MEMORIES AND PROGRAMMABLE LOGIC DEVICES

9

Basic memory structure – ROM – PROM – EPROM – EEPROM – EAPROM, RAM – Static and dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) –Implementation of combinational logic circuits using PLA, PAL.

LIST OF EXPERIMENTS

1. Design of Adders, Subtractors and Code converters.
2. Design of Multiplexers and Demultiplexers.
3. Design of Encoders and Decoders.
4. Design of Magnitude Comparators.
5. Design and implementation of counters using flip-flops.



6. Design and implementation of shift registers.

TOTAL: 45 +15 = 60 PERIODS

OUTCOMES

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

- Apply Boolean algebra and simplification procedures relevant to digital logic.
- Design various combinational digital circuits using logic gates.
- Analyze the procedures of synchronous sequential circuits.
- Examine the functioning of asynchronous sequential circuits.
- Develop the memories and programmable devices.
- Design and implement digital logic circuits and flip-flops.

TEXT BOOKS

1. M.Morris Mano and Michael D.Ciletti, "Digital Design", Pearson, Sixth Edition, 2019.
2. David Harris, "Digital Design and Computer Architecture", Morgan Kaufmann, Second Edition, 2015.

REFERENCES

1. Charles H. Roth, Jr, "Fundamentals of Logic Design", Jaico Books, Fourth Edition, 2002.
2. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 2015.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/106/117106086/>-(Digital Design)
2. <https://nptel.ac.in/courses/108/105/108105132/>-(Integrated Circuits)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	2	-	-	-	2	2	3	3
2	3	3	3	2	2	2	-	-	-	2	1	2	3
3	3	3	3	2	2	2	-	-	-	2	2	3	3
4	3	2	3	2	2	2	-	-	-	2	2	2	3
5	3	3	3	3	2	2	-	-	-	2	2	3	3
6	3	2	3	2	2	2	-	-	-	1	1	3	2
AVG	3.0	3.0	3.0	2.0	2.0	2.0	-	-	-	2.0	2.0	3.0	3.0

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


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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 blocks of algorithms(statements, state, control flow, 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 and methods; 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 – 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. Implementing 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. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions.(Factorial, largest number In a list, area of shape)
7. Implementing programs using Strings.(reverse,palindrome,charactercount,replacingcharacters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing 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	PSO1	PSO2
1	3	3	2	1	2	–	–	–	–	–	2	3	2
2	3	2	2	–	3	–	–	–	–	–	2	3	3
3	3	3	2	1	3	–	–	–	–	–	2	3	3
4	3	2	2	–	3	–	–	–	–	–	2	3	3
5	2	3	2	2	3	–	–	–	1	–	2	3	3
6	3	3	3	2	3	–	1	1	2	1	2	3	3
AVG	2.8	2.7	2.2	1.5	2.8	0.0	1.0	1.0	1.5	1.0	2.0	3.0	2.8

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


Chairman - BoS

23EEEC301

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 preventability 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





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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, the 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.

Chairman - BoS



SEMESTER IV

23ECT401

ELECTROMAGNETIC FIELDS

L T P C

3 1 0 4

OBJECTIVES

- To explain the basics of static electric field and the associated laws.
- To gain knowledge on the basics of static magnetic field and the associated laws.
- To summarize the basic laws associated with magneto statics.
- To discuss the significance of Time varying fields.
- To explain the principles of propagation of EM waves.

UNIT I INTRODUCTION

9

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem, Verify theorems for different path, surface and volume.

UNIT II ELECTROSTATICS

9

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law.

UNIT III MAGNETOSTATICS

9

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Calculation of magnetic field intensity for various current distributions Magnetic circuits, Behaviour of magnetic materials, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS

9

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields, Observing the Phenomenon of wave propagation with the aid of Maxwell's equations.

UNIT V PLANE ELECTROMAGNETIC WAVES

9

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary

TOTAL: 45 PERIODS



OUTCOMES

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

- Relate the fundamentals of vector, coordinate system to electromagnetic concepts.
- Analyze the characteristics of Electrostatic field.
- Determine various parameters associated with Magneto statics.
- Discuss the significance of time varying fields.
- Analyze the effects of different EM waves in material space.

TEXT BOOKS

1. D.K. Cheng, "Field and wave electromagnetic", Pearson (India), Third Edition, 2019.
2. M.N.O.Sadiku and S.V. Kulkarni, "Principles of electromagnetics", Oxford, Fifth Edition, 2020.

REFERENCES

1. Edward C. Jordan & Keith G. Balmain, "Electromagnetic waves and Radiating Systems", Prentice-Hall Electrical Engineering Series, Second Edition, 2012
2. W.H. Hayt and J.A. Buck, "Engineering electromagnetic", McGraw-Hill (India), Eighth Edition, 2015.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/106/108106073/>-(Electromagnetic Fields)
2. <https://nptel.ac.in/courses/117/103/117103065/>-(Electromagnetic Theory)

Mapping of COs-POs & PSOs

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

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



23ECT402

NETWORKS AND SECURITY

LT P C

3 0 0 3

OBJECTIVES

- To explain the Network Models and data link layer functions.
- To impart knowledge on routing in the Network Layer.
- To elaborate the methods of communication and congestion control by the Transport layer.
- To create exposure the Network Security Mechanisms.
- To discuss various hardware security attacks and their countermeasures.

UNIT I NETWORK MODELS AND DATALINK LAYER

9

Overview of Networks and its Attributes – Network Models – OSI, TCP/IP, Addressing –Introduction to Datalink Layer – Error Detection and Correction – Ethernet(802.3)- Wireless LAN – IEEE 802.11, Bluetooth – Flow and Error Control Protocols – HDLC – PPP.

UNIT II NETWORK LAYER PROTOCOLS

9

Network Layer – IPv4 Addressing – Network Layer Protocols(IP,ICMP and Mobile IP) Unicast and Multicast Routing – Intra domain and Inter domain Routing Protocols – IPv6 Addresses – IPv6 – Datagram Format - Transition from IPv4 to IPv6.

UNIT III TRANSPORT AND APPLICATION LAYERS

9

Transport Layer Protocols – UDP and TCP Connection and State Transition Diagram - Congestion Control and Avoidance (DEC bit, RED) - QoS - Application Layer Paradigms – Client – Server Programming – Domain Name System – World Wide Web, HTTP, Electronic Mail.

UNIT IV NETWORK SECURITY

9

OSI Security Architecture – Attacks – Security Services and Mechanisms – Encryption –Advanced Encryption Standard – Public Key Cryptosystems – RSA Algorithm – Hash Functions – Secure Hash Algorithm – Digital Signature Algorithm..

UNIT V HARDWARE SECURITY

9

Introduction to hardware security, Hardware Trojans, Side – Channel Attacks – Physical Attacks and Countermeasures – Design for Security. Introduction to Block chain Technology.

TOTAL: 45 PERIODS



OUTCOMES

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

- Develop the Network Models, layers and functions.
- Analyze and classify the routing protocols.
- Develop the functions of the transport and application layer.
- Analyze and choose the network security mechanisms.
- Determine the hardware security attacks and countermeasures.

TEXT BOOKS

1. Behrouz.A.Forouzan, "Data Communication and Networking", TMH, Fifth Edition, 2017.
2. Bhunia Swarup, "Hardware Security –A Hands On Approach", Morgan Kaufmann, First Edition, 2018.

REFERENCES

1. James.F.Kurose and Keith.W.Ross, "Computer Networking – A Top – Down Approach", Pearson, Sixth Edition, 2017.
2. Doughlas.E.Comer, "Computer Networks and Internets", Pearson Education, Sixth Edition, 2015.

E-RESOURCES

1. <https://nptel.ac.in/courses/106105031>- (Cryptography and Network security)
2. <https://nptel.ac.in/courses/106105162>- (Advanced Encryption Standard)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECT403

MICROPROCESSORS AND MICROCONTROLLERS

**L T P C
3 0 0 3**

OBJECTIVES

- To impart the architecture, functions and programming of 8086 microprocessor.
- To inculcate system bus structure, memory and I/O interfacing of 8086 microprocessor.
- To gain knowledge of memory and peripheral interfacing applications using 8086 microprocessors.
- To impart the architecture and programming concepts of 8051 microcontroller.
- To acquire insights into the basic concepts to develop implement microcontroller based applications.
- To familiarize with programming of microprocessors and microcontrollers.

UNIT I THE 8086 MICROPROCESSOR

9

Introduction to 8086 - Microprocessor architecture - Addressing modes - Instruction set and assembler directives - Assembly language programming - Modular Programming - Linking and Relocation - Stacks - Procedures - Macros - Interrupts and interrupt service routines - Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE

9

8086 signals - Basic configurations - System bus timing - System design using 8086 - I/O programming - Introduction to Multiprogramming - System Bus Structure - Multiprocessor configurations - Coprocessor, Closely coupled and loosely Coupled configurations - Introduction to advanced processors.

UNIT III I/O INTERFACING

9

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard /display controller - Interrupt controller - DMA controller - Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER

9

Architecture of 8051 - Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER

9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming - LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

TOTAL: 45 PERIODS



OUTCOMES

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

- Describe the architecture and fundamental programming concepts of the 8086 microprocessor.
- Examine the system bus structure, memory organization, and I/O interfacing of the 8086 microprocessor.
- Develop memory and peripheral interfacing applications using the 8086 microprocessor.
- Explain the architecture and programming features of the 8051 microcontroller..
- Analyze about the interfacing of 8051 microcontroller.
- Implement programming and interfacing solutions for microprocessors and microcontrollers.

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family Architecture, Programming and Design", Prentice Hall of India, Second Edition, 2022.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson education, Second Edition, 2011.

REFERENCES

1. Douglas V.Hall, "Microprocessors and Interfacing Programming and Hardware", TMH, 2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", Tata McGraw Hill, Third Edition, 2012.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105102/>- (Microprocessors and Microcontrollers)
2. <https://nptel.ac.in/courses/106/108/106108100/>- (Microprocessors and Microcontrollers)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECE401

DIGITAL SIGNAL PROCESSING

(Lab Embedded Theory Course)

L T P C

3 0 2 4

OBJECTIVES

- To introduce and apply DFT and FFT techniques for frequency-domain analysis and efficient digital filtering of signals.
- To impart the IIR concepts for various transformation techniques with structural form.
- To describe the FIR filters in different methods to form structure realizations.
- To gain the knowledge of word length representation and its quantization process.
- To provide the various application process in signal processing systems.
- To write the MATLAB programming for the signal processing techniques and simulate.

UNIT I DISCRETE FOURIER TRANSFORM

9

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITE IMPULSE RESPONSE FILTERS

9

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS

9

Design of FIR filters - symmetric and Anti-symmetric FIR filters-- design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

UNIT IV FINITE WORD LENGTH EFFECTS

9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V DSP APPLICATIONS

9

Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor - Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture Fixed and Floating point architecture principles.



LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences.
2. Linear and Circular convolutions.
3. Auto correlation and Cross Correlation.
4. Frequency Analysis using DFT.
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF).
7. Verification of Sampling Theorem.

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor.
2. Perform MAC operation using various addressing modes.
3. Generation of various signals and random noise.
4. Design multirate filters and to develop DSP applications.
5. Develop and implement various DSP algorithms using MATLAB.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Apply DFT and FFT techniques for frequency-domain signal analysis.
- Design IIR digital filters using analog filter transformation methods.
- Implement FIR digital filters with linear phase characteristics.
- Analyze finite word length effects and errors in digital signal processing systems.
- Examine the DSP applications including multirate processing, adaptive filters, and DSP architectures.
- Implement DSP algorithms using MATLAB and DSP processors through practical experiments.

TEXT BOOKS

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms and Applications", Pearson Education / Prentice Hall, Fifth Edition, 2014.
2. V. Oppenheim, R.W. Schaffer and J.R. Buck, "Discrete-Time Signal Processing", Indian Reprint, Pearson, Eighth Edition, 2014.

REFERENCES

1. Emmanuel C. Ifeachor and Barrie W. Jervis, "Digital Signal Processing", Pearson Education / Prentice Hall, Second Edition, 2012.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2011.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/102/117102060/>-(Digital Signal Processing)



2. <https://nptel.ac.in/courses/108/106/108106151/>-(Digital Signal Processing)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECE402

COMMUNICATION SYSTEMS

L T P C

(Lab Embedded Theory Course)

3 0 2 4

OBJECTIVES

- To introduce the Amplitude Modulation Schemes.
- To discuss the random process and sampling.
- To impart knowledge on various digital techniques.
- To inculcate the basic concept of various digital modulation schemes.
- To gain knowledge on digital demodulation techniques.
- To simulate and evaluate DPSK, QPSK, and QAM modulation and detection schemes.

UNIT I AMPLITUDE MODULATION

9

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, and Super heterodyne Receiver.

UNIT II RANDOM PROCESS AND SAMPLING

9

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Low pass sampling – Aliasing - Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding.

UNIT III DIGITAL TECHNIQUES

9

Pulse modulation, Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder.

UNIT IV DIGITAL MODULATION SCHEME

9

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Principle of DPSK.

UNIT V DEMODULATION TECHNIQUES

9

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

LIST OF EXPERIMENTS

1. AM- Modulator and Demodulator.



2. FM - Modulator and Demodulator.
3. Signal sampling and TDM.
4. Pulse Code Modulation and Demodulation.
5. Pulse Amplitude Modulation and Demodulation.
6. Digital Modulation – ASK, PSK, FSK.
7. Delta Modulation and Demodulation.
8. Simulation of ASK, FSK, and BPSK Generation and Detection Schemes.
9. Simulation of DPSK, QPSK and QAM Generation and Detection Schemes.
10. Simulation of Linear Block and Cyclic Error Control coding Schemes.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Discuss about Amplitude Modulation techniques.
- Apply the concepts of Random Process to the design of communication systems.
- Discuss various digital techniques and sampling codes.
- Analyze various signals and its spectrum for digital modulation.
- Explain coherent communication with waveforms.
- Design AM, FM & Digital modulators for error coding schemes.

TEXT BOOKS

1. Simon Haykins, "Communication Systems", Wiley, Fifth Edition, 2021
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", Oxford University press, Fourth Edition, 2011.

REFERENCES

1. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, Fourth Edition, 2002.
2. B.Sklar, "Digital Communications Fundamentals and Applications", Pearson Education, Second Edition, 2011.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/102/117102059/>-(Communication Engineering)
2. <https://nptel.ac.in/courses/117/101/117101051/>-(Digital Communication)

Mapping of COs-POs & PSOs:

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

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


Chairman - BoS

23ECE403

LINEAR INTEGRATED CIRCUITS

(Lab Embedded Theory Course)

L T P C

3 0 2 4

OBJECTIVES

- To introduce the basic building blocks of linear integrated circuits.
- To develop the linear and non-linear applications of operational amplifiers.
- To gain knowledge on theory and applications of analog multipliers and PLL.
- To familiarize students in theory of ADC and DAC.
- To enhance knowledge on features of waveform generators and special function ICs.
- To develop hands on experience in designing and simulation of electronic circuits.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS

9

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations – MOSFET Operational Amplifiers – LF155 and TL082.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS

9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL

9

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronization.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS

9

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion - Over-sampling A/D Converters, Sigma – Delta converters.



UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs

9

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators – Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Switched capacitor filter IC MF10, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto couplers and fibre optic IC.

LIST OF EXPERIMENTS

DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS

1. Inverting, Non inverting and differential amplifiers.
2. RC Phase shift oscillator and Wien Bridge Oscillator.
3. RC Integrator and Differentiator circuits using Op-Amp.
4. Instrumentation amplifier.
5. Active low-pass, High pass & Band pass filters.
6. PLL Characteristics and its use as frequency multiplier, clock synchronization.
7. R-2R ladder type D/A converter using Op-Amp.
8. Schmitt Trigger circuit with Predictable hysteresis
9. Tuned Collector Oscillator.
10. Design of Astable and Monostable multivibrators using op-amp.
11. Simulation of Active low-pass, high-pass and band-pass filters using op-amp.
12. Simulation of Astable and Monostable multivibrators using NE555 Timer.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Analyze the basic building blocks of Linear Integrated circuits in circuit design.
- Examine the linear and non linear applications of OP - AMPS.
- Design analog multiplier and PLL in practical applications.
- Describe ADC and DAC interfacing for delta converter.
- Analyze the waveforms using Op-Amp based Circuits.
- Design the Op-Amp based circuits using SPICE software.

TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd, Fifth Edition, 2018.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata Mc Graw-Hill, Fourth Edition, 2016.

REFERENCES



1. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PHI, Sixth Edition, 2001.
2. Ramakant A. Gayakwad, "OP-AMP and Linear ICs", Prentice Hall / Pearson Education, Fourth Edition, 2015.

E-RESOURCES

1. <https://nptel.ac.in/courses/108108111/-> (Op-Amps).
2. https://onlinecourses.nptel.ac.in/noc20_ee45/preview (Analog Electronic Circuits).

Mapping of COs-POs & PSOs

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

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


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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

S

SEMESTER V

23ECT501

TRANSMISSION LINES AND RF SYSTEMS

L T P C

3 1 0 4

OBJECTIVES

- To introduce the various types of transmission lines and its characteristics.
- To discuss about high frequency line, power and impedance measurements.
- To impart knowledge in impedance matching using Smith Chart.
- To inculcate the passive filters and active RF components.
- To summarize the concepts of a RF system transceiver design.

UNIT I TRANSMISSION LINE THEORY

9+3

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion less line - Loading and different methods of loading - Line not terminated in Z_0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuit edlines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES

9+3

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement on lines -Reflection losses-Measurement of VSWR and wavelength.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER

9+3

Impedance matching: Quarter wave transformer, One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart - Application of Smith chart, Solutions of problems using Smith chart- Single and double stub matching using Smith chart.

UNIT IV WAVEGUIDES

9+3

Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides.

UNIT V RF SYSTEM DESIGN CONCEPTS

9+3

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise amplifiers, Power amplifiers.

TOTAL: 45+15: 60 PERIODS

OUTCOMES

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

- Analyze the characteristics of transmission lines and its losses.
- Calculate the standing wave ratio and input impedance in high frequency transmission lines.
- Analyze impedance matching by stubs using Smith Charts.
- Implement the characteristics of TE and TM waves.
- Design a RF transceiver system for wireless communication.

TEXT BOOKS

1. John D Ryder, "Networks lines and fields", Prentice Hall of India, NewDelhi, 2015.
2. Mathew M.Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2023.

REFERENCES

1. Reinhold Ludwig, Powel Bretchko, "RF Circuit Design theory and Applications" Pearson Education Asia, Second Edition, 2011.
2. W. Alan Davis, Krishna Agarwal, "Radio Frequency Circuit Design", John wiley & Sons, 2009.

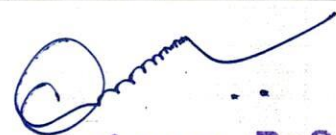
E-RESOURCES

1. <https://nptel.ac.in/courses/108/103/108103141> (Transmission Lines And Waveguides)
2. <https://nptel.ac.in/courses/117/101/117101056> (Transmission Lines And Waveguides)

Mapping of COs-POs & PSOs:

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

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


Chairman - BoS

23ECE501

VLSI AND CHIP DESIGN

L T P C

3 0 2 4

OBJECTIVES

- To impart the fundamentals of CMOS circuits and their characteristics.
- To gain knowledge on design and realization of combination logic circuits.
- To know the features of sequential logic circuits and clocking strategies.
- To facilitate different arithmetic building blocks and memory devices using CMOS
- To acquire insights into ASIC Design functioning and testability of VLSI circuits.
- To familiarize with coding of combinational and sequential circuits using Verilog/VHDL.

UNIT I MOS TRANSISTOR PRINCIPLES

9

MOS logic families (NMOS and CMOS) - Ideal and Non Ideal IV Characteristics - CMOS devices - MOS(FET) Transistor Characteristic under Static and Dynamic Conditions - Technology Scaling - Power consumption.

UNIT II COMBINATIONAL LOGIC CIRCUITS

9

Propagation Delays –stick diagram- Layout diagrams – Examples of combinational logic design - Elmore's constant – Static Logic Gates – Dynamic Logic Gates – Pass Transistor Logic – Power Dissipation – Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES

9

Static Latches and Registers - Dynamic Latches and Registers – Pipelines – Non bistable Sequential Circuits – Timing classification of Digital Systems – Synchronous Design - Self-Timed Circuit Design.

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE AND ARITHMETIC CIRCUIT

9

Interconnect Parameters–Capacitance, Resistance and Inductance, Electrical Wire Models -Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA) – Memory Architecture and Building Blocks – Memory Core and Memory Peripherals Circuitry.

UNIT V ASIC DESIGN AND TESTING

9

Introduction to wafer to chip fabrication process flow - Microchip design process & issues in test and verification of complex chips - embedded cores and SOCs - Fault models - Test coding - ASIC Design Flow –Introduction to ASICs –Introduction to test benches –Writing test benches in Verilog HDL – Automatic test pattern generation –Design for testability – Scan design: Test interface and boundary scan.

LIST OF EXPERIMENT

1. Design of basic combinational and sequential (Flip-flops) circuits using HDL. Simulate it using Xilinx/ Altera Software and implement by Xilinx/Altera FPGA.
2. Design an Adder Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software.
4. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
5. Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/Automatic Layout .
6. Design and simulate a 4-bit synchronous counter using a Flip-Flops. Generate Manual/ Automatic Layout.
7. Design and Simulate a CMOS Inverting Amplifier.
8. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
9. Design and simulate simple 5 transistor differential amplifier.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Analyze the features and characteristics of CMOS circuits.
- Examine combinational MOS circuits and power strategies.
- Construct sequential circuits and timing systems.
- Analyze arithmetic building blocks and memory subsystems.
- Implement ASIC Design Process and VLSI Testing.
- Write HDL code for basic as well as advanced digital integrated circuits and to design, simulate and extract the layouts of digital & Analog IC blocks using EDA tools.

TEXT BOOKS

1. Jan Rabaey, Anantha Chandrakasan, "Digital Integrated Circuits: A Design Perspective", PHI, 2016.
2. Neil HE Weste, Kamran Eshraghian, "Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.

REFERENCES

1. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers, 2001.
2. Samiha Mourad and Yervant Zorian, "Principles of Testing Electronic Systems", Wiley 2000.

E-RESOURCES

1. [https://nptel.ac.in/courses/117/101/117101058/-\(VLSI Design\)](https://nptel.ac.in/courses/117/101/117101058/-(VLSI%20Design))
2. [https://onlinecourses.nptel.ac.in/noc20_ee29/-\(CMOS Digital VLSI Design\)](https://onlinecourses.nptel.ac.in/noc20_ee29/-(CMOS%20Digital%20VLSI%20Design))

Mapping of COs-POs & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO09	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	2	-	-	-	2	2	3	3
2	3	3	3	3	3	2	-	-	-	2	2	3	3
3	3	3	3	3	3	2	-	-	-	2	2	3	3
4	3	3	3	3	3	2	-	-	-	2	2	3	3
5	3	3	3	3	3	2	-	-	-	2	2	3	3
6	3	3	3	3	3	2	-	-	-	2	2	3	3
AVG	3	3	3	3	3	2	-	-	-	2	2	3	3

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


Chairman - BoS

23ECE502

OPTICAL AND MICROWAVE ENGINEERING

L T P C

3 0 2 4

OBJECTIVES

- To summarize the principles of fiber-optic communications and various type of Propagation, modes, Configuration of optical fibers.
- To know about the transmission Characteristic of optical fiber and different kind of Losses, signal distortion in optical fiber
- To describe the concepts of optical sources, detectors and transmission techniques.
- To gain knowledge about the microwave tubes and different kind of microwave generation techniques
- To explain the characteristics of various types of microwave devices.
- To apply various idea about optical fiber measurements and various microwave measurements.

UNIT I INTRODUCTION TO OPTICAL FIBER COMMUNICATION

9

Introduction - The General Systems - Advantages of Optical Fiber Communication- Ray Theory Transmission: Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays - Electromagnetic Mode Theory for Optical Propagation: Modes in a Planar Guide, Phase and group velocity - Cylindrical Fiber: Step index fibers, Graded index fibers - Single mode fibers: Cutoff wavelength.

UNIT II TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER

9

Attenuation-absorption-scattering losses-bending losses-core and cladding losses-signal dispersion-inter symbol interference and bandwidth-intra modal dispersion-material dispersion-waveguide dispersion-polarization mode dispersion-inter modal dispersion-optimization of single mode fiber-characteristics of single mode fiber-R-I Profile cutoff wavelength-dispersion calculation-mode field diameter.

UNIT III OPTICAL SOURCES AND DETECTORS

9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps -LED and its Characteristics - LASER diodes and its characteristics. Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects comparisons of photo detectors.

UNITIV MICROWAVETUBE

9

Microwave tubes, Limitations of conventional active devices at microwave Frequency, Classification of Microwave tubes, Two cavities Klystron, Reflex Klystron, Magnetron, Traveling wave tube, Backward wave oscillators, Gyro Devices: Their schematic, Principle of operation, Performance characteristic and their applications.

UNIT V PASSIVE AND ACTIVE MICROWAVE DEVICES

9

Microwave Passive components: Directional Coupler- Power Divider- Magic Tee- attenuator-resonator- Principles of Microwave Semiconductor Devices: Gunn Diodes - IMPATT diodes Schottky Barrier diodes- PIN diodes.

LIST OF EXPERIMENTS

OPTICAL EXPERIMENTS

1. Numerical Aperture and Mode Characteristics of Fibers.
2. Measurement of connector, bending and fiber attenuation losses.
3. DC characteristics of LED and Photo diode
4. V I Characteristics of LASER Diode

MICROWAVE EXPERIMENTS

1. Characteristics of Gunn Diode.
2. VSWR Measurement.
3. Scattering parameters of Magic Tee
4. Directional Coupler - Directivity and Coupling Coefficient - S - parameter measurement

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Analyze the fundamental knowledge about the fiber optic elements and their different modes and configurations.
- Examine the Transmission Characteristics Associated with Dispersion and Polarization Techniques.
- Design various optical sources and detectors.
- Analyze the transmission characteristics of optical fiber.
- Implement the characteristic analysis of microwave source.
- Test the characteristics of microwave components and optical fibers.

TEXT BOOKS

1. David M. Pozar, "Microwave Engineering", Wiley India, Fourth Edition, 2012.
2. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education India Private Limited, 2016.

REFERENCES

1. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2020.
2. John M.Senior, "Optical fiber communication", Pearson Education, Second Edition, 2007.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/103/108103141/> -(Microwave Engineering)
2. <https://nptel.ac.in/courses/117/101/117101054/> -(Optical Communication)



SENGUNTHAR ENGINEERING COLLEGE (AUTONOMOUS)

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NAAC Accredited with 'A' Grade

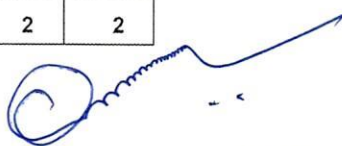
TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23EEC501

INDUSTRIAL TRAINING

L T P C
0 0 4 2

The students shall undergo Industrial Training during summer / winter vacation. The industry/organization shall be selected with the approval of the Head of the Department. A faculty member nominated by the Head of the Department shall act as the faculty coordinator and shall be responsible for monitoring and evaluation of the student's progress.

OUTCOMES

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

- CO1: Participate in the projects in industries during his or her industrial training.
- CO2: Describe the use of advanced tools and techniques encountered during the industrial training and visit.
- CO3: Interact with industrial personnel and follow engineering practices and discipline prescribed in the industry.
- CO4: Develop awareness about general workplace behaviour and build interpersonal and team skills.
- CO5: Prepare professional work reports and presentations.


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SEMESTER VI

23ECT601

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

L T P C
3 0 0 3

OBJECTIVES

- To introduce uninformed and Heuristic search techniques.
- To facilitate the techniques for reasoning under uncertainty.
- To introduce Machine Learning and supervised learning algorithms.
- To gain knowledge about ensembling and unsupervised learning algorithms.
- To acquire insights in deep learning using neural networks.

UNIT I PROBLEM SOLVING

9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

UNIT II PROBABILISTIC REASONING

9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

UNIT III SUPERVISED LEARNING

9

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING

9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

UNIT V NEURAL NETWORKS

9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks – Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout

TOTAL: 45PERIODS



OUTCOMES

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

- Analyze appropriate search algorithms for problem solving.
- Design Bayesian inference and casual networks.
- Discuss supervised learning models and support vector machine.
- Examine ensembling and unsupervised models.
- Design deep learning neural network models.

TEXT BOOKS

1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Pearson Education, Fourth Edition, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

REFERENCES

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.

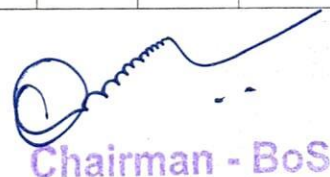
E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_ce107/preview - (Artificial Intelligence and Machine Learning in Materials Engineering).
2. https://onlinecourses.nptel.ac.in/noc22_cs56/preview - (An Introduction to Artificial Intelligence)

Mapping of COs-POs & PSO

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

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


Chairman - BoS

23ECE601

EMBEDDED SYSTEMS AND IOT DESIGN

L T P C

3 0 2 4

OBJECTIVES

- To discuss the design process of an embedded system.
- To explain the real-time processing in an embedded system.
- To introduce the evolution of the Internet of Things (IoT).
- To impart knowledge on architecture and design flow of IoT.
- To build an IoT based system.

UNIT I EMBEDDED SYSTEMS

9

Embedded System Design Process – Model Train Controller – ARM Processor – Instruction Set Preliminaries – CPU – Programming Input and Output – Supervisor Mode – Exceptions and Trap – Models for programs – Assembly, Linking and Loading – Compilation Techniques.

UNIT II PROCESSES AND OPERATING SYSTEMS

9

Multiple Tasks and Multiple Processes – Multirate Systems – Pre-emptive real-time Operating systems – Priority based scheduling – Inter-process Communication Mechanisms – Distributed Embedded Systems – Design Example – Audio Player, Engine Control Unit and Video Accelerator.

UNIT III IOT AND ARDUINO PROGRAMMING

9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Tool chain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS

9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V IOT SYSTEM DESIGN

9

Basic building blocks of an IoT device – Raspberry Pi – Board – Linux on Raspberry Pi – Interfaces – Programming with Python – Case Studies: Home Automation, Smart Cities, Environment and Agriculture.



LIST OF EXPERIMENTS

Experiments using 8051.

1. Programming Arithmetic and Logical Operations in 8051.
2. Design of a Digital Clock using Timers/Counters in 8051.

Experiments using ARM

1. Interfacing ADC and DAC
2. Blinking of LEDs and LCD
3. Interfacing key board and Stepper Motor.
4. Mini projects for IoT
5. Measure the Distance Using Ultrasonic Sensor and Make Led Blink using Arduino.
6. Detect the Vibration of an Object Using Arduino.
7. Sense a Finger When it is Placed on Board Using Arduino
8. Temperature Notification Using Arduino
9. Connect with the Available Wi-Fi Using Arduino

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Develop a model of an embedded system.
- Illustrate the concepts of real time operating systems.
- Compare the communication models in IOT
- Discuss the architecture and protocols of IoT.
- Design IoT applications using Arduino / Raspberry Pi / open platform.

TEXT BOOKS

1. Marilyn Wolf, Computers as Components, "Principles of Embedded Computing System Design", Morgan Kaufmann, Third Edition, 2012
2. Arshdeep Bahga, Vijay Madisetti, "Internet – of- Things – A Hands on Approach", Universities Press, 2015.

REFERENCES

1. Mayur Ramgir, "Internet – of – Things, Architecture, Implementation and Security", First Edition, Pearson Education, 2020.
2. Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson Education, 2013

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc20_cs14/preview - (Embedded System Design).
2. <https://archive.nptel.ac.in/courses/106/105/106105193/> - (Embedded System Design with ARM).



Mapping of COs-POs & PSO

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

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



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23EEJ601

PROJECT WORK – PHASE I

L T P C

0 0 8 4

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 may be assigned to a single student or to a group of students, not exceeding 4 per group.
- The project work shall be undertaken by students either in industry or in the college.
- The total credit for project work in semester VI is 4.
- 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.
- Sixty percentage of Project work to be completed in this Project Work - Phase I.
- 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	PSO1	PSO2
Mapping outcome	3	3	3	3	3	3	3	3	3	3	3	3	3

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



Chairman - BoS

23ECP501

WIDE BANDGAP DEVICES

L T P C

3 0 0 3

OBJECTIVE

- To introduce the concept of wide band gap (WBG) devices and its application in real world.
- To discuss the basics operation and switching characteristics of WBG power devices.
- To impart knowledge on design principles of modern power devices.
- To gain knowledge on the high frequency design complexity and PCB design.
- To explore the practical applications of wide band gap devices.

UNIT I WBG DEVICES AND THEIR APPLICATION IN REAL WORLD

9

Review of semiconductor basics - Operation and characteristics of the SiC Schottky Barrier Diode - SiC DMOSFET and GaN HEMT - Review of Wide bandgap semiconductor technology - Advantages and disadvantages

UNIT II SWITCHING CHARACTERIZATION OF WBG

9

Turn - on and Turn - off characteristics of the device - Hard switching loss analysis - Double pulse test set-up

UNIT III DRIVERS FOR WIDE BAND GAP DEVICES

9

Gate driver - Impact of gate resistance - Gate drivers for wide bandgap power devices - Transient immunity integrated gate drivers

UNIT IV HIGH FREQUENCY DESIGN COMPLEXITY AND PCB DESIGNING

9

Effects of parasitic inductance - Effects of parasitic capacitance - EMI filter design for high frequency power converters High frequency PCB design - Conventional power loop design - High frequency power loop optimization - Separation of power from signal PCB

UNIT V APPLICATIONS OF WIDE BANDGAP DEVICES

9

Consumer electronics applications - Wireless power transfer applications - Electric vehicle applications - Renewable energy sources applications

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the principles of wide band gap devices.
- Illustrate the reliability issues and testing methods.
- Design the gate drivers and power devices.
- Design high frequency power converters and PCBs.
- Obtain In depth knowledge on practical applications of wide band gap devices.



TEXT BOOKS

1. A. Lidow, J. Strydom, M. D. Rooij, D. Reusch, GaN Transistors for Efficient Power Conversion, Wiley, 2014.
2. G. Meneghesso, M. Meneghini, E. Zanoni, "Gallium Nitride-enabled High Frequency and High Efficiency Power Conversion," Springer International Publishing, 2018.

REFERENCES

1. Donald.A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw Hill, Third Edition, 2010.
2. John Okyere Attia "Circuits and Electronics" First Edition 2021.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/105/108105158/> (Analog Electronic Circuits)
2. <https://nptel.ac.in/courses/117/103/117103063/> (Basic Electronics)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



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23ECP502

VALIDATION AND TESTING TECHNOLOGY

L T P C
3 0 0 3

OBJECTIVES

- To introduce the various IC technology.
- To impart the knowledge on characteristics of CMOS technology.
- To discuss the analysis and design of CMOS inverters.
- To describe the CMOS characterization and its estimation.
- To gain knowledge on the concept of the circuit and device level testing methods.

UNIT I TECHNOLOGY INTRODUCTION

9

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. VLSI Fabrication – Oxidation – Lithography – Diffusion - Ion Implantation - Metallization - Integrated Resistors and Capacitors.

UNIT II MOS THEORY ANALYSIS-I

9

Basic Electrical Properties of MOS Circuits: I_{ds} - V_{ds} Relationships - MOS Transistor Threshold Voltage V_{th} , g_m , g_{ds} , Figure of Merit wo - Short Channel and Narrow Channel Width Effects.

UNIT III MOS THEORY ANALYSIS- II

9

Pass Transistor - Transmission Gate - NMOS Inverter - Various Pull-ups - CMOS Inverter Analysis and Design - Bi-CMOS Inverters - Latch up in CMOS Circuits.

UNIT IV CMOS CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION

9

Sheet Resistance R_S - conductivity and its Concept to MOS - Area Capacitance Units - Calculations - Delays, Driving Large Capacitive Loads, Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Reliability.

UNIT V BASIC OF SILICON VALIDATION

9

Need for Testing - Testing at Various Levels - Objectives of Testing - VLSI Test process and Test Equipment - Types of Testing: Functionality Tests, Silicon Debug, Manufacturing Tests, Defect during manufacturing - Fault Modelling, Observability and Controllability - Fault Coverage - Fault Sampling - ATE, Test economics.

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the CMOS fabrication process.
- Analyze the fundamental concepts of MOS FET and its characteristics.
- Develop the concept of MOS theory and analysis.
- Implement the concept of CMOS performance estimation and circuit characterization.



design the basics of Testing and Fault Modeling.

TEXT BOOKS

1. Kamran Ehraghian, Douglas A. Pucknell and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems" PHI, EEE, First Edition, 2005.
2. Neil H. E. Weste and David. Harris Ayan Banerjee,, "CMOS VLSI Design: A Circuits and Systems Perspective" Fourth Edition, 2015.

REFERENCES

1. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2013.
2. Etienne Sicard, Sonia Delmas Bendhia, "Basics of CMOS Cell Design", TMH, EEE, 2007

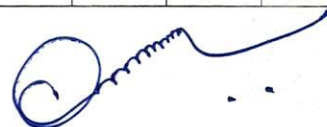
E-RESOURCES

1. <https://nptel.ac.in/courses/106103016/>-(VLSI Design Verification and Test)
2. https://onlinecourses.nptel.ac.in/noc24_ee102/-(VLSI Design flow)

Mapping of COs-POs & PSOs

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

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



Chairman - BoS

23ECP503

LOW POWER IC DESIGN

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of low power low voltage VLSI design.
- To discuss the architecture level approach.
- To facilitate about the how power added to architecture.
- To inculcate the low power multiplier architecture.
- To understand the concept of low power low voltage memories.

UNIT I FUNDAMENTALS OF LOW POWER CIRCUITS

9

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects – Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT II LOW-POWER DESIGN APPROACHES

9

Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach – Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

UNIT III LOW-VOLTAGE LOW-POWER ADDERS

9

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low Voltage Low Power Design Techniques – Trends of Technology and Power Supply Voltage, Low Voltage Low-Power Logic Styles.

UNIT IV LOW-VOLTAGE LOW-POWER MULTIPLIERS

9

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh-Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier

UNIT V LOW-VOLTAGE LOW-POWER MEMORIES

9

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre charge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TOTAL: 45 PERIODS



OUTCOMES

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

- Apply the fundamentals of Low power circuit design.
- Develop the knowledge of architectural approaches.
- Analyze and design Low-Voltage Low-Power adder circuits.
- Design Low Power, Low Voltage multiplier Circuits.
- Design the Low-Voltage Low-Power Memories.

TEXT BOOKS

1. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", TMH, 2011.
2. Kiat-Seng Yeo, Kaushik Roy, "Low-Voltage, Low-Power VLSI Subsystems", TMH Professional Engineering, 2004.

REFERENCES

1. Ming-BO Lin, "Introduction to VLSI Systems: A Logic, Circuit and System Perspective", CRC Press, 2012.
2. Siva G. Narendran, Anatha Chandrakasan, "Leakage in Nanometer CMOS Technologies", Springer, 2005.

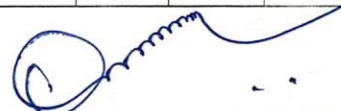
E-RESOURCES

1. <https://archive.nptel.ac.in/courses/106/105/106105034/> (Low power VLSI circuits & system).
2. https://onlinecourses.nptel.ac.in/noc24_ee80/ (Low Voltage CMOS Circuit Operation)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	-	-	-	-	-	2	2	2
2	3	2	1	2	3	-	-	-	-	-	1	2	2
3	3	3	3	2	2	-	-	-	-	-	1	2	2
4	2	3	3	3	3	-	-	-	-	-	1	2	3
5	3	3	3	2	2	-	-	-	-	-	2	2	2
AVG	2.8	2.8	2.4	2.4	2.4	-	-	-	-	-	1.4	2	2

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


Chairman - BoS

23ECP504

VLSI TESTING AND DESIGN FOR TESTABILITY

L T P C
3 0 0 3

OBJECTIVES

- To introduce the logic and fault simulation and testability measures.
- To discuss the design for testability.
- To facilitate the interfacing and testing of memory.
- To gain knowledge on the power management techniques in testing.
- To inculcate the testability in analog circuits.

UNIT I TEST REQUIREMENTS AND METRICS

9

Validation platforms- SOC design methodology, IP components, Integration, Clocking, I/Os and interfaces, Device modes, Logic, memories, analog, I/Os, power management; Test requirements- Test handoffs, Testers Where DUT and DFT fit into design / framework; Test- ATPG, DFT, BIST, COF, TTR; Test cost metrics and test economics; Logic fault models- SAF, TDF, PDF, Iddq, St-BDG, Dy-BDG, SDD; Basics of test generation and fault simulation- Combinational circuits, Sequential; Specific algorithmic approaches, CAD framework, Optimisations.

UNIT II SCAN DESIGN AND BIST

9

Scan Design- Scan design requirements, Types of scan and control mechanisms, Test pattern construction for scan, Managing scan in IPs and SOCs, Scan design optimisations, Partitioning, Clocking requirements for scan and delay fault testing, Speed of operation; BIST – Framework, Controller configurations, FSMs, LFSRs, STUMPS architecture, Scan compression and bounds, Test per cycle, Test per scan, Self-testing and self-checking circuits, Online test.

UNIT III MEMORY TEST AND TEST INTERFACES

9

Memory Test -Memory fault models, Functional architecture as applicable to test, Test of memories, Test of logic around memories, BIST controller configuration, Test of logic around memories, DFT and architecture enhancements, Algorithmic optimisations; Test Interfaces-Test control requirements, Test interfaces - 1500, JTAG, Hierarchical, serial control, Module / IP test, SOC test, Board test, System test, Boundary scan.

UNIT IV DESIGN CONSIDERATIONS AND POWER MANAGEMENT DURING TEST

9

Design Considerations- Design considerations, Physical design congestion, Partitioning, Clocks, Test modes, Pins, Test scheduling, Embedded test, Architecture improvements, Test in the presence of security; Power management during test- Methods for low power test, ATPG methods, DFT methods, Scan methods, Low power compression, Test of power management, Implications of power excursions, Optimisations.



UNIT V ANALOG TEST

9

Test requirements. DFT methods. BIST methods. Test versus measurement. Defect tests versus performance tests. Tests for specific modules - PLL, I/Os, ADC, DAC, SerDes, etc. RF test requirements.

TOTAL: 45 PERIODS

OUTCOMES

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

- Design logic and fault simulation requirements and testability measures.
- Analyze the design for Testability.
- Develop interfacing and memory testing.
- Implement and test with power management techniques.
- Analyze fault Detection in analog circuits.

TEXT BOOK

1. Vishwani Agrawal, Michael Bushnell, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Springer, 2002.
2. Weste/Harris "CMOS VLSI Design: A Circuits and Systems Perspective" Fourth Edition 2015.

REFERENCE

1. M. L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital Memory and Mixed Signal VLSI Circuits", Springer, 2013.
2. M. Huth and M. Ryan, Logic in Computer Science, Cambridge Univ. Press, 2004

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/105/117105137/>-(Digital VLSI Testing)
2. <https://archive.nptel.ac.in/courses/106/103/106103116/>-(Design verification and Test of Digital VLSI Circuits).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	1	-	-	-	-	-	-	-	-	-	3	3
2	3	2	3	2	-	-	-	-	-	-	1	3	3
3	2	3	2	3	1	1	-	-	-	-	2	3	2
4	-	-	1	1	-	-	-	-	-	-	3	3	3
5	-	-	-	-	-	2	-	-	-	1	-	3	2
AVG	2	2	2	2	1	1.5	-	-	-	1	2	3	2.6

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

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SENGUNTHAR ENGINEERING COLLEGE

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23ECP505

MIXED SIGNAL IC DESIGN TESTING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the mixed-signal devices and the need for testing these devices.
- To discuss the various measurement terminologies.
- To facilitate DAC converters and its applications.
- To describe binary search methods and ADC testing.
- To facilitate the Clock and Serial Data Communications Channels.

UNIT I MIXED – SIGNAL TESTING

9

Common Types of Analog and Mixed- Signal Circuits – Applications of Mixed-Signal Circuits - Post-Silicon Production Flow - Test and Packing – Characterization versus Production Testing - Test and Diagnostic Equipment - Automated Test Equipments – Wafer Probers – Handlers – E-Beam Probers – Focused Ion Beam Equipments – Forced –Temperature

UNIT II YIELD, MEASUREMENT ACCURACY, AND TEST TIME

9

Yield - Measurement Terminology - Repeatability, Bias, and Accuracy - Calibrations and Checkers - Tester Specifications - Reducing Measurement Error with Greater Measurement Time – Guardbands - Effects of Measurement Variability on Test Yield - Effects of Reproducibility and Process Variation on Yield - Statistical Process Control

UNIT III DAC TESTING

9

Basics of Data Converters -Principles of DAC and ADC Conversion, Data Formats, Comparison of DACs and ADCs, DAC Failure Mechanisms - Basic DC Tests - Transfer Curve Tests - Dynamic DAC Tests - Tests for Common DAC Applications

UNIT IV ADC TESTING

9

ADC Testing Versus DAC Testing - ADC Code Edge Measurements - Edge Code Testing Versus Center Code Testing, Step Search and Binary Search Methods, Servo Method, Linear Ramp Histogram Method, Histograms to Code Edge Transfer Curves, Rising Ramps Versus Falling Ramps, Sinusoidal Histogram Method - DC Tests and Transfer Curve Tests - Dynamic ADC Tests - Tests for Common ADC Applications

UNIT V CLOCK AND SERIAL DATA COMMUNICATIONS CHANNEL MEASUREMENT

9

Synchronous and Asynchronous Communications - Time-Domain Attributes of a Clock Signal - Frequency-Domain Attributes of a Clock Signal - Communicating Serially Over a Channel - Bit Error Rate Measurement - Methods to Speed Up BER Tests in Production - Deterministic Jitter Decomposition - Jitter Transmission Tests.

TOTAL: 45 PERIODS



OUTCOMES

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

- Obtain in depth knowledge about the fundamentals of mixed signal circuits.
- Analyze the various measurement terminologies.
- Apply the knowledge to implement the DAC testing.
- Implement testing of Analog to Digital converters.
- Analyze the attributes of clock signals.

TEXTBOOK

1. Gordon W.Roberts, Friedrich Taenzler, Mark Burns, "An Introduction to Mixed-signal IC Test and Measurement" Oxford University Press, Inc.2012.
2. M.L.Bushnell and V.D.Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers, 2013.

REFERENCES

1. Bramhananda Marathe , Sandhya Nerale , "Analog and mixed-signal verification", 2015.
2. NihalKularatna "Digital and Analogue Instrumentation: Testing and Measurement", Institution of Engineering and Technology, 2002.

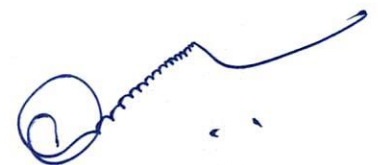
E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/106/117106030/>-(Analog IC Design).
2. <http://www.facweb.iitkgp.ac.in/~ashismaity/>-(Mixed Signal Circuits and Systems-on-Chip).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	2	-	-	-	-	2	3	3
2	3	3	2	2	1	2	-	-	-	-	2	3	2
3	3	3	2	2	2	2	-	-	-	-	2	3	2
4	3	3	3	2	2	1	-	-	-	-	2	1	2
5	3	3	3	2	2	2	-	-	-	-	3	2	1
AVG	3	3	2.8	2.2	1.8	1.8	-	-	-	-	2.2	2.4	2

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



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23ECP506

ANALOG IC DESIGN

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basics of MOS Circuits.
- To discuss the noise characteristics of amplifiers.
- To inculcate the performance parameters of amplifiers.
- To facilitate operational amplifier performance parameters and compensation techniques.
- To gain knowledge on detection and testing of faults.

UNIT I SINGLE STAGE AMPLIFIERS

9

Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower, differential amplifier with active load, Cascode and Folded Cascode configurations with active load, design of Differential and Cascode Amplifiers – to meet specified SR, noise, gain, BW, ICMR and power dissipation, voltage swing, high gain amplifier structures.

UNIT II HIGH FREQUENCY AND NOISE CHARACTERISTICS OF AMPLIFIERS

9

Miller effect, association of poles with nodes, frequency response of CS, CG and Source Follower, Cascode and Differential Amplifier stages, statistical characteristics of noise, noise in Single Stage amplifiers, noise in Differential Amplifiers.

UNIT III FEEDBACK AND SINGLE STAGE OPERATIONAL AMPLIFIERS

9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, single stage Op Amps, two-stage Op Amps, input range limitations, gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IV STABILITY, FREQUENCY COMPENSATION

9

Multipole Systems, Phase Margin, Frequency Compensation, Compensation Of Two Stage Op Amps, Slewing In Two Stage Op Amps, Other Compensation Techniques.

UNIT V LOGIC CIRCUIT TESTING

9

Faults in Logic Circuits- Basic Concepts of Fault Detection- Design for Testability- Ad Hoc Techniques, Level-Sensitive Scan Design, Partial Scan, Built-in Self-Test.

TOTAL: 45 PERIODS



OUTCOMES

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

- Design amplifiers to meet user specifications.
- Analyze the frequency and noise performance of amplifiers.
- Design feedback amplifiers and one stage op amps.
- Analyze stability of op amp using frequency compensation.
- Implement techniques in logic circuit testing.

TEXTBOOKS

1. Behzad Razavi, "Design Of Analog Cmos Integrated Circuits", Tata Mcgraw Hill, Second Edition, 2016.
2. Parag K.Lala, "An Introduction to Logic Circuit Testing", Morgan & Claypool Publishers, 2009.

REFERENCES

1. Willey M.C. Sansen, "Analog Design Essentials", Springer, 2006.
2. Jacob Baker "CMOS: Circuit Design, Layout, And Simulation", Wiley IEEE Press, Third Edition, 2010.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/106/117106030/> (ANALOG IC DESIGN).
2. http://www.ee.iitm.ac.in/vlsi/courses/ee5320_2021/ (ANALOG IC DESIGN).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	2	-	-	-	-	2	3	3
2	3	3	2	2	1	2	-	-	-	-	2	3	2
3	3	3	2	2	2	2	-	-	-	-	2	3	2
4	3	3	3	2	2	1	-	-	-	-	2	1	2
5	3	3	3	2	2	2	-	-	-	-	3	2	1
AVG	3	3	2.6	2.2	1.8	1.8	-	-	-	-	2.2	2.4	2

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


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PROFESSIONAL ELECTIVE II

23ECP507

ADVANCED DIGITAL SIGNAL PROCESSING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the concepts of discrete time random signal processing.
- To discuss multirate signal processing and its applications.
- To inculcate linear prediction and filters process.
- To introduce the concept of prediction theory and filtering.
- To facilitate the concept of spectrum estimation techniques.

UNIT I MULTIRATE SIGNAL PROCESSING

9

Review of Convolution, DFT and ZT, Multirate Signal Processing - Decimation, Interpolation, Sampling Rate Conversion by a rational factor – digital filter banks, sub band coding, Quadrature Mirror Filter.

UNIT II DISCRETE TIME RANDOM PROCESSES

9

Stationary random processes, Autocorrelation, Rational Power Spectra, Filters for generating random Processes from white noise and inverse filter – AR, MA and ARMA processes – relationship between autocorrelation and the filter parameters.

UNIT III LINEAR PREDICTION AND FILTERING

9

Linear Prediction – Forward and Backward - Wiener filters for filtering and prediction – FIR Wiener Filter – IIR Wiener Filter – Kalman Filter.

UNIT IV ADAPTIVE FILTERING

9

FIR adaptive filters – adaptive filters based on steepest descent method – LMS algorithm – Variants of LMS algorithm – adaptive echo cancellation – adaptive channel equalization – RLS Algorithm.

UNIT V SPECTRUM ESTIMATION

9

Estimation of power spectra from finite duration observations of signals – Non parametric methods of spectrum estimation – the Bartlett and the Welch method – Parametric spectrum estimation – AR, MA and ARMA.

TOTAL : 45 PERIODS



OUTCOMES

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

- Implement the concept of multi rate signal processing and demonstrate its applications.
- Analyze power spectral density of discrete random signals and systems.
- Develop linear prediction and filtering techniques for signal detection and estimation.
- Analyze adaptive filtering problems and demonstrate its application
- Implement power spectrum estimation techniques to random signals.

TEXT BOOKS

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. P. Vaidyanathan, "Multirate systems and filter banks", Prentice Hall Inc., 1993.

REFERENCES

1. Monson H. Hayes, "Statistical digital signal processing and modeling", John Wiley and Sons Inc. New York, Indian reprint, 2008.
2. Sophocles J. Orfanidis, "Optimum Signal Processing", McGraw Hill, 2000.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/101/117101001/> (Advanced Digital Signal Processing).
2. https://onlinecourses.nptel.ac.in/noc24_ee76/ (Signal Processing Techniques and its Applications)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	2	-	-	-	-	1	2	3
2	3	3	3	2	2	2	-	-	-	-	2	3	2
3	3	3	3	2	2	2	-	-	-	-	2	2	2
4	3	3	3	2	2	2	-	-	-	-	2	3	2
5	3	3	2	2	1	1	-	-	-	-	1	2	3
AVG	3	3	3	2	1.8	1.8	-	-	-	-	1.6	2.4	2.4

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


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23ECP508

IMAGE PROCESSING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the concept of digital image fundamentals and transforms.
- To inculcate the simple image enhancement techniques in Spatial and Frequency domain.
- To discuss the concept of degradation functions and restoration techniques.
- To facilitate image segmentation and representation techniques.
- To develop with image compression and recognition methods

UNIT I DIGITAL IMAGE FUNDAMENTALS

9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT

9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION

9

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

UNIT IV IMAGE SEGMENTATION

9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION

9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL : 45 PERIODS



OUTCOMES

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

- Analyze the basics and fundamentals of digital image processing.
- Describe an image using the techniques of smoothing, sharpening and enhancement.
- Apply the restoration concepts and filtering techniques.
- Analyze the image segmentation and representation techniques.
- Examine the compression and recognition methods for various color models.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, Third Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.

REFERENCES

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, 2011.

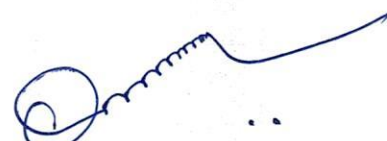
E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/105/117105135/> (Digital Image Processing)
2. <https://archive.nptel.ac.in/courses/106/105/106105032/> (Digital Image Processing (WEB))

Mapping of COs-POs & PSOs

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

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



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23ECP509

SPEECH PROCESSING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of speech signal and extracts various speech features.
- To discuss the various features of speech and measure its distortion.
- To gain knowledge on different speech coding techniques and applications.
- To describe the speech enhancement, text-to-speech synthesis system.
- To facilitate the conversion process with meaningful insights and patterns from speech data.

UNIT I FUNDAMENTALS OF SPEECH

9

The Human speech production mechanism, Discrete-Time model of speech production, Speech perception - human auditory system, Phonetics - articulatory phonetics, acoustic phonetics, and auditory phonetics, Categorization of speech sounds, Spectrographic analysis of speech sounds, Pitch frequency, Pitch period measurement using spectral and cepstral domain, Formants, Evaluation of Formants for voiced and unvoiced speech.

UNIT II SPEECH FEATURES AND DISTORTION MEASURES

9

Significance of speech features in speech-based applications, Speech Features – Cepstral Coefficients, Mel Frequency Cepstral Coefficients (MFCCs), Perceptual Linear Prediction (PLP), Log Frequency Power Coefficients (LFPCs), Speech distortion measures–Simplified distance measure, LPC-based distance measure, Spectral distortion measure, Perceptual distortion measure.

UNIT III SPEECH CODING

9

Need for speech coding, Waveform coding of speech – PCM, Adaptive PCM, DPCM, ADPCM, Delta Modulation, Adaptive Delta Modulation, G.726 Standard for ADPCM, Parametric Speech Coding – Channel Vcoders, Linear Prediction Based Vcoders, Code Excited Linear Prediction (CELP) based Vcoders, Sinusoidal speech coding techniques, Hybrid coder, Transform domain coding of speech

UNIT IV SPEECH ENHANCEMENT

9

Classes of Speech Enhancement Algorithms, Spectral-Subtractive Algorithms - Multiband Spectral Subtraction, MMSE Spectral Subtraction Algorithm, Spectral Subtraction Based on Perceptual Properties, Wiener Filtering - Wiener Filters in the Time Domain, Wiener Filters in the Frequency Domain, Wiener Filters for Noise Reduction, Maximum-Likelihood Estimators, Bayesian Estimators, MMSE and Log-MMSE Estimator, Subspace Algorithms.

UNIT V SPEECH SYNTHESIS AND APPLICATION

9

A Text-to-Speech systems (TTS), Synthesizers technologies – Concatenative synthesis, Use of Formants for concatenative synthesis, Use of LPC for concatenative synthesis, HMM-based synthesis,



Sinewave synthesis, Speech transformations, Watermarking for authentication of a speech, Emotion recognition from speech.

TOTAL : 45 PERIODS

OUTCOMES

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

- Obtain in depth knowledge about the fundamentals of speech process.
- Analyze the various speech features for speech related applications.
- Implement an appropriate speech coder for a given application.
- Analyze the speech enhancement algorithm in frequency domain.
- Design a text-to-speech synthesis system for various applications.

TEXT BOOKS

1. Shaila D. Apte, "Speech and Audio Processing", Wiley India (P) Ltd, New Delhi, 2012.
2. Philipos C. Loizou, "Speech Enhancement Theory and Practice", CRC Press, Inc., United States, Second Edition, 2013.

REFERENCES

1. Rabiner L. R. and Juang B. H, "Fundamentals of speech recognition", Pearson Education, 2008.
2. Thomas F. Quatieri, "Discrete-time speech signal processing - Principles and practice", Pearson, 2012.

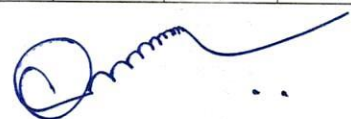
E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ee117/-(Digital Speech Processing)
2. <https://archive.nptel.ac.in/courses/117/105/117105145/>-(Digital Speech Processing)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	2	1	1	2	1	-	-	-	-	2	3	3
2	1	2	1	1	2	1	-	-	-	-	2	2	2
3	1	2	1	1	2	1	-	-	-	-	1	1	2
4	3	-	3	3	-	3	-	-	-	-	2	2	3
5	3	-	3	3	-	3	-	-	-	-	2	2	2
AVG	1.8	2	1.8	1.8	2	1.8	-	-	-	-	1.8	2	2.4

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


Chairman - BoS

23ECP510

SOFTWARE DEFINED RADIO

L T P C
3 0 0 3

OBJECTIVES

- To introduce the concepts of software radios.
- To discuss RF implementation challenges for software defined radios.
- To gain knowledge on digital synthesis with analog signal synthesis.
- To facilitate the software and hardware requirements in antennas.
- To discuss the concept of DSP Processors and Object Brokers.

UNIT I INTRODUCTION TO SOFTWARE RADIO

9

The Need for Software Radios. Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio.

UNIT II RF IMPLEMENTATION

9

Purpose of RF front – end, Dynamic range, RF receiver front – end topologies, Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, Hybrid DDS – PLL systems, Applications of Direct Digital Synthesis.

UNIT III DIGITAL GENERATION OF SIGNALS

9

Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Performance of direct digital synthesis systems, Applications of direct digital synthesis.

UNIT IV SMART ANTENNAS

9

Benefits of smart antennas, Structures for beamforming systems, Smart antenna algorithms, Hardware implementation of smart antennas, Digital Hardware Choices-Key hardware elements.

UNIT V HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES

9

DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, Object Brokers, GNU Radio-USRP. Case Studies: SPEAK easy, JRTS, SDR-3000.

TOTAL: 45 PERIODS

OUTCOMES

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

- Demonstrate Software radios and technologies for its implementation.
- Analyze Radio frequency implementation issues.
- Design various digital synthesis procedures.
- Implement Smart antenna techniques for software defined radio.
- Analyze various hardware and software requirements for software defined radios.



TEXT BOOKS

1. Jeffrey Hugh Reed, "Software Radio: A Modern Approach to Radio Engineering", Prentice Hall Professional, 2002.
2. Tony J Roupael, "RF and DSP for SDR", Elsevier Newnes Press, 2008.

REFERENCES

1. P. Kenington, "RF and Baseband Techniques for Software Defined Radio", Artech House, 2005.
2. Behrouz. F. Bourjney, "Signal Processing for Software defined Radios", Lulu 2008.

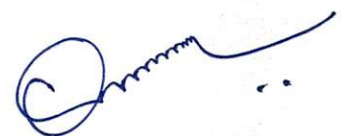
E-RESOURCES

1. <https://archive.nptel.ac.in/courses/117/107/108107107/>-(Basics of software Defined Radios and Applications).
2. <https://archive.nptel.ac.in/courses/106/101/106101061/>-(Software Engineering)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECP511

DSP ARCHITECTURE AND PROGRAMMING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the architecture of programmable DSP processors.
- To implement various standard DSP algorithms in DSP Processors.
- To use the Programmable DSP Processors to build real-time DSP systems.
- To facilitate the implementation of DSP algorithm.
- To inculcate the applications of DSP processor.

UNIT I ARCHITECTURES FOR PROGRAMMABLE DSP PROCESSORS

9

Basic Architectural features, DSP Computational building blocks, Bus architecture and memory, Data addressing capabilities, Address generation Unit, Programmability and program execution, Speed issues, Features for external interfacing

UNIT II TMS320C5X PROGRAMMABLE DSP PROCESSOR

9

Architecture of TMS320C54xx DSP processors, Addressing modes – Assembly language Instructions - Memory space, interrupts, and pipeline operation of TMS320C54xx DSP Processor, On-Chip peripherals, Block Diagram of TMS320C54xx DSP starter kit.

UNIT III TMS320C6X PROGRAMMABLE DSP PROCESSOR

9

Commercial TI DSP processors, Architecture of TMS320C6x DSP Processor, Linear and Circular addressing modes, TMS320C6x Instruction Set, Assembler directives, Linear Assembly, Interrupts, Multichannel buffered serial ports, Block diagram of TMS320C67xx DSP Starter Kit and Support Tools.

UNIT IV IMPLEMENTATION OF DSP ALGORITHMS

9

DSP Development system, On-chip, and On-board peripherals of C54xx and C67xx DSP development boards, Code Composer Studio (CCS) and support files, Implementation of Conventional FIR, IIR, and Adaptive filters in TMS320C54xx/TMS320C67xx DSP processors for real-time DSP applications, Implementation of FFT algorithm for frequency analysis in real-time.

UNIT V APPLICATIONS OF DSP PROCESSORS

9

Voice scrambling using filtering and modulation, Voice detection and reverse playback, Audio effects, Graphic Equalizer, Adaptive noise cancellation, DTMF signal detection, Speech thesis using LPC, Automatic speaker recognition

TOTAL: 45 PERIODS



OUTCOMES

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

- Implement the architectural features of DSP Processors.
- Determine the organization of TMS320C54xx DSP processors.
- Analyze the solutions using TMS320C6x DSP Processor.
- Design peripherals of DSP Algorithms.
- Analyze the applications of DSP Processors.

TEXT BOOKS

1. Avtar Singh and S. Srinivasan, "Digital Signal Processing – Implementations using DSP Microprocessor with Examples from TMS320C54xx", Cengage Learning India Private Limited, Delhi 2012.
2. Rulph Chassaing and Donald Reay, "Digital Signal Processing and Applications", Wiley India (P) Ltd, New Delhi, Second Edition, 2008.

REFERENCES

1. B.Venkataramani and M.Bhaskar, "Digital Signal Processors – Architecture, Programming and Applications", Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.
2. TMS320C5416/6713 DSK user manual at <https://www.ti.com>.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/108/106/108106149/>-(Real-Time Digital Signal Processing).
2. https://onlinecourses.nptel.ac.in/noc19_ee70/-(Mapping Signal Processing Algorithms to Architectures).

Mapping of COs-POs & PSOs

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

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


Chairman - BoS

23ECP512

COMPUTER VISION

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts related to Image formation and processing.
- To discuss the feature detection, matching and detection.
- To familiar with feature based alignment and motion estimation.
- To inculcate the skills on 3D reconstruction.
- To gain knowledge on image based rendering and recognition.

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING

9

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION

9

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods

UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION

9

Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos.

UNIT IV 3D RECONSTRUCTION

9

Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION

9

View interpolation Layered depth images - Light fields and Lomography - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category recognition - Context and scene understanding- Recognition databases and test sets.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the basic knowledge, theories and methods in image processing and computer vision.
- Develop basic and advanced image processing techniques in Open CV.
- Apply 2D a feature-based based image alignment, segmentation and motion estimations.
- Apply 3D image reconstruction techniques.
- Design the innovative image processing and computer vision applications.



TEXTBOOKS

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, Second Edition, 2015.

REFERENCES

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. E. R. Davies, "Computer and Machine Vision", Academic Press, Fourth Edition, 2012.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc19_cs58/-(Computer Vision).
2. <https://opencv.org/opencv-free-course/>-(Computer Vision).

Mapping of Cos- Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO3
1	3	1	1	1	1	-	-	2	1	3	2	2	1
2	3	3	3	2	3	-	-	2	1	2	2	3	2
3	3	3	2	2	3	-	-	1	1	2	2	3	2
4	2	3	3	2	3	-	-	2	1	2	3	2	3
5	2	3	3	2	2	2	-	3	1	2	3	3	3
AVG	2.6	2.6	2.4	1.8	2.4	2	-	2	1	2.2	2.4	2.6	2.2

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


Chairman - BoS

PROFESSIONAL ELECTIVE III

23ECP513

WEARABLE DEVICES

L T P C

3 0 0 3

OBJECTIVES

- To introduce the hardware requirements of wearable systems.
- To discuss the communication and security aspects in the wearable devices.
- To inculcate the body area network architecture.
- To facilitate smart textile and fabrication techniques.
- To gain knowledge on application of wearable devices.

UNIT I TRANSMISSION LINE THEORY

9

Wearable Systems- Introduction, Need for Wearable Systems, Drawbacks of Conventional Systems for Wearable Monitoring, Applications of Wearable Systems, Types of Wearable Systems, Components of wearable Systems. Sensors for wearable systems-Inertia movement sensors, Respiration activity sensor, Inductive plethysmography, Impedance plethysmography, pneumography, Wearable ground reaction force sensor.

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES

9

Wear ability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS

9

Need for wireless monitoring, Definition of Body area network, BAN and Healthcare, Technical Challenges- System security and reliability, BAN Architecture – Introduction, Wireless communication Techniques.

UNIT IV SMART TEXTILE

9

Introduction to smart textile- Passive smart textile, active smart textile. Fabrication Techniques Conductive Fibres, Treated Conductive Fibres, Conductive Fabrics, Conductive Inks. Case study: smart fabric for monitoring biological parameters - ECG, respiration

UNIT V APPLICATIONS OF WEARABLE SYSTEMS

9

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

TOTAL: 45 PERIODS



OUTCOMES

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

- Analyze the concepts of wearable systems.
- Obtain in depth knowledge about security aspects and energy harvestings in wearable devices.
- Assess the applications of body area network in health care systems.
- Examine the concept of smart textile and fabrication techniques.
- Compare the various wearable devices used in healthcare system.

TEXTBOOKS

1. Zhang and Yuan-Ting, "Wearable Medical Sensors and Systems", Springer, 2013
2. Edward Sazonov and Micheal R Neuman, "Wearable Sensors: Fundamentals, Implementation and Applications", Elsevier, 2014

REFERENCES

1. Sandeep K.S, Gupta, Tridib Mukherjee and Krishna Kumar Venkatasubramanian, " Body Area Networks Safety, Security, and Sustainability", Cambridge University Press, 2013.
2. Guang-Zhong Yang, Body Sensor Networks, Springer, 2006.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc23_ge21/preview
2. https://onlinecourses.nptel.ac.in/noc22_ge17/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO3
1	3	2	1	1	2	-	1	-	-	-	-	1	1
2	3	2	1	1	2	-	1	-	-	-	-	1	1
3	3	2	1	1	2	-	1	-	-	-	-	1	1
4	3	2	1	1	2	-	1	-	-	-	-	1	1
5	3	2	1	1	2	-	1	-	-	-	-	1	1
AVG	3	2	1	1	2	-	1	-	-	-	-	1	1

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


Chairman - BoS

23ECP514

MEDICAL ELECTRONICS

**L T P C
3 0 0 3**

OBJECTIVES

- To gain knowledge about the various physiological parameters both electrical and non electrical.
- To discuss about the Bio-potential recording and also the method of transmitting physiological parameters.
- To describe about the various assist devices used in the hospitals.
- To explain about equipment used for physical medicine.
- To examine the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING

9

Sources of biomedical signals, Bio-potentials, Bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics.

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT

9

pH, PO₂, PCO₂, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES

9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY

9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION

9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL: 45 PERIODS



OUTCOMES

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

- Apply the knowledge on electro-physiological parameters and recordings of bio-potentials of the human body.
- Examine the characteristics of the non-electrical physiological parameters and their measurements.
- Design the various medical assist devices used in the hospitals.
- Analyze the principles and methods of physical medicine and bio-telemetry.
- Analyze the different categories of medical instrumentation devices.

TEXT BOOKS

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, Second Edition, 2015.
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", TATA Mc Graw-Hill, New Delhi, Third Edition, 2014.

REFERENCES

1. John G. Webster, "Medical Instrumentation Application and Design", Wiley India Edition, Fifth Edition, 2021.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, Fourth Edition, 2002.

E- RESOURCES

1. <https://nptel.ac.in/courses/102/106/102106069/> (Material And Energy Balances)
2. https://nptel.ac.in/content/storage2/courses/downloads_new/112106248/noc18_me55. (Assist Devices).

Mapping of COs - POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	2	-	-	-	-	3	3	2
2	3	3	3	2	2	3	-	-	-	-	2	2	2
3	3	3	3	3	3	2	-	-	-	-	3	3	2
4	3	3	1	1	3	2	-	-	-	-	2	3	3
5	3	3	3	3	3	3	-	-	-	-	2	3	2
AVG.	3	3	2.6	2.4	2.8	2.4	-	-	-	-	2.4	2.8	2.2

1- Low, 2 - Medium, 3 - High, '-' – No correlation


Chairman - BoS

23ECP515

THERAPEUTIC EQUIPMENT

L T P C

3 0 0 3

OBJECTIVES

- To introduce the principles of cardiac assist devices.
- To discuss the use of biomechanical therapeutic equipment.
- To impart the working of therapeutic body care equipment.
- To describe about therapeutic dental care equipment.
- To inculcate the heat and photon therapy equipment and the use of lasers in medicine.

UNIT I CARDIAC AND RESPIRATORY THERAPY EQUIPMENT

9

Cardiac Pacemaker: Internal and External Pacemaker– Programmable pacemakers. Cardiac Defibrillators: AC and DC Defibrillator- Internal and External Defibrillators - Protection Circuit, Defibrillator analyzers. Cardiac ablation catheter. Types of Ventilators – Pressure, Volume, and Time controlled. Basic principles of electromechanical, pneumatic and electronic ventilators, Patient Cycle Ventilators, Ventilator testing. Humidifiers, Nebulizers, Inhalators.

UNIT II BIOMECHANICAL THERAPEUTIC EQUIPMENT

9

Electro diagnosis, Therapeutic radiation, Electrotherapy, Electrodes, Stimulators for Nerve and Muscle, Functional Electrical Stimulation. peripheral nerve stimulator, ultrasonic stimulators, Stimulators for pain and relief - Inferential Therapy Unit, TENS. GAIT Assessment and Therapy. Continuous Passive Motion unit, Cervical / Lumber Traction Machine -Traction Table.

UNIT III BODY CARE EQUIPMENT

9

Skin Treatment: Ultrasonic spot remove, vacuum therapy unit, Skin tightening, Wrinkle Reduction, Facial and Rejuvenation. Laser hair therapy machine. Body Slimmer/Shaper – Deep Heat Therapy, Massager, Fitness – Treadmill, Bike.

UNIT IV DENTAL CARE EQUIPMENT

9

Dental Chair - Dental Hand pieces and Accessories: Evolution of rotary equipment, Low-speed handpiece, High-speed handpiece, Hand piece maintenance. Vacuum and Pneumatic techniques: Vacuum techniques, Oral evacuation systems, Vacuum pump, Pneumatic techniques, Dental compressor. Decontamination Unit and constant fumigation unit. Dental Radiography: Dental X-ray Machine.

UNIT V HEAT & PHOTON THERAPY EQUIPMENT

9

High frequency heat therapy, Principle, Short wave diathermy, Microwave diathermy, Ultrasonic therapy, Lithotripsy. Therapeutic UV and IR Lamps. Basic principles of Biomedical LASERS: Applications of lasers in medicine, CO₂laser, He-Ne laser, Nd-YAG and Ruby laser.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the suitable therapeutic devices for ailments related to cardiology, pulmonology and neurology.
- Assess the performance of various biomechanical therapeutic equipment.
- Develop applications in body care equipment.
- Implement the concepts of maintenance in dental care equipment.
- Analyze the different types of therapies and applications of lasers in biomedical applications.

TEXTBOOKS

1. Khandpur. R.S., "Handbook of Biomedical Instrumentation". Tata McGrawHillPub. Co., Ltd. Second Edition, 2003.
2. John.G.Webster. "Medical Instrumentation, Application and Design", Wiley&sons, Inc., NewYork. Fourth Edition, 2009.

REFERENCES

1. Leslie Cromwell, Fred. J. Weibell & Erich. A.Pfeiffer. "Biomedical Instrumentation and Measurements". Prentice Hall Inc. Second Edition, 2000.
2. Joseph. J. Carr, John Michael Brown, "Introduction to Biomedical Equipment Technology", Prentice Hall and Technology, 2008.

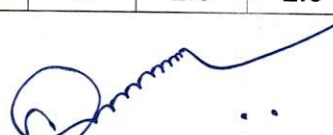
E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_bt37/preview
2. https://onlinecourses.swayam2.ac.in/nou23_bt05/preview

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	2	3	2	-	-	-	2	3	3
2	3	3	3	3	2	3	2	-	-	-	2	3	2
3	3	3	3	3	2	3	2	-	-	-	2	3	2
4	3	2	2	3	2	3	2	-	-	-	2	2	3
5	3	3	2	3	2	3	2	-	-	-	2	2	3
AVG	3	2.8	2.6	3	2	3	2	-	-	-	2	2.6	2.6

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


Chairman - BoS

23ECP516

MEDICAL IMAGING SYSTEMS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the generation of X-ray and its uses in Medical imaging.
- To describe the working principle of Computed Tomography.
- To discuss the techniques used for visualizing various sections of the body.
- To inculcate the principles of different radio diagnostic equipment in Imaging.
- To facilitate the radiation therapy techniques and radiation safety.

UNIT I X RAYS

9

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography - discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

UNIT II COMPUTED TOMOGRAPHY

9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors – Viewing systems – spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques – back projection and iterative method.

UNIT III MAGNETIC RESONANCE IMAGING

9

Fundamentals of magnetic resonance- properties of electromagnetic waves : speed , amplitude, phase, orientation and waves in matter - Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system – system magnet (Permanent, Electromagnet and Superconductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR IMAGING

9

Radioisotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera – Principle of operation, collimator, photomultiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET

UNIT V RADIATION THERAPY AND RADIATION SAFETY

9

Radiation therapy – linear accelerator, Telegamma Machine. SRS – SRT – Recent Techniques in radiation therapy – 3D CRT – IMRT – IGRT and Cyber knife – radiation measuring instruments Dosimeter, film badges, Thermo Luminescent dosimeters – electronic dosimeter – Radiation protection in medicine – radiation protection principles

TOTAL: 45 PERIODS



OUTCOMES

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

- Describe the working principle of the X-ray machine and its application.
- Analyze the principles of computed tomography.
- Apply the technique used for visualizing various sections of the body using Magnetic Resonance Imaging.
- Implement the applications of radionuclide imaging.
- Analyze different imaging techniques and choose appropriate imaging equipment for better diagnosis and outline the methods of radiation safety.

TEXTBOOKS

1. Isaac Bankman, I. N. Bankman , "Handbook Of Medical Imaging: Processing and Analysis- Biomedical Engineering", Academic Press, 2000.
2. Khin Wee Lai, Dyah Ekashanti Octorina Dewi "Medical Imaging Technology", Springer Singapore, 2015.

REFERENCES

1. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw – Hill, New Delhi, 2003.
2. Dougherty, Geoff (Ed.), "Medical Image Processing - Techniques and Applications", Springer-Verlag New York, 2011.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ee87/preview
2. https://onlinecourses.nptel.ac.in/noc22_bt34/preview

Mapping of COs-POs & PSOs

CO	PO ₁	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	2	-	-	-	-	3	2	3
2	3	3	3	2	2	1	-	-	-	-	2	2	3
3	3	3	2	2	2	2	-	-	-	-	2	2	2
4	3	3	3	2	2	1	-	-	-	-	2	2	2
5	3	3	3	3	2	2	-	-	-	-	1	2	2
AVG	3	3	2.8	2.2	2	1.6	-	-	-	-	2	2	2.4

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


Chairman - BoS

23ECP517

BRAIN COMPUTER INTERFACE AND APPLICATIONS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of brain computer interface.
- To discuss the various electro physiological sources.
- To facilitate the feature extraction methods.
- To explain the various feature Translation methods.
- To gain knowledge on applications of Neuroprosthesis.

UNIT I INTRODUCTION TO BCI

9

Fundamentals of BCI – Structure of BCI system – Classification of BCI – Invasive, Non-invasive and Partially invasive BCI – EEG signal acquisition - Signal Preprocessing – Artifacts removal.

UNIT II ELECTRO PHYSIOLOGICAL SOURCES

9

Sensor motor activity – Mu rhythm, Movement Related Potentials – Slow Cortical Potentials-P300 - Visual Evoked Potential - Activity of Neural Cells - Multiple Neuromechanisms.

UNIT III FEATURE EXTRACTION METHODS

9

Time/Space Methods – Fourier Transform, PSD – Wavelets – Parametric Methods – AR,MA,ARMA models – PCA – Linear and Non-Linear Features.

UNIT IV FEATURE TRANSLATION METHODS

9

Linear Discriminant Analysis – Support Vector Machines - Regression – Vector Quantization– Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks.

UNIT V APPLICATIONS OF BCI

9

Functional restoration using Neuroprosthesis - Functional Electrical Stimulation, Visual Feedback and control - External device control, Case study: Brain actuated control of mobile Robot.

TOTAL: 45 PERIODS

OUTCOMES

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

- Describe BCI system and its potential applications.
- Analyze the event related potentials and sensory motor rhythms.
- Analyze the features suitable for BCI.
- Design the feature translation for a BCI system.
- Develop the BCI for various applications.

TEXTBOOKS

1. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010.
2. M. G. Sumithra, Rajesh Kumar Dhanaraj, Mariofanna Milanova, "Brain-Computer Interface: Using Deep Learning Applications", Wiley-Scrivener, First Edition, 2023.

REFERENCES

1. Bruce J Fisch, "FISCH & Spehlmann's EEG Primer", Elsevier, 2024.
2. Ivan Selesnick, Iyad Obeid, Joseph Picone, "Biomedical Signal Processing: Innovation and Applications", 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc22_ee87/preview
2. <https://nptel.ac.in/courses/108108167/preview>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	2	2	2	-	-	-	-	2	3	3
2	3	3	3	2	2	1	-	-	-	-	2	2	2
3	3	3	3	2	2	1	-	-	-	-	1	1	2
4	3	3	3	1	3	2	-	-	-	-	2	2	3
5	3	3	3	3	3	2	-	-	-	-	2	2	2
AVG	3	3	3	2	2.4	1.6	-	-	-	-	1.8	2	2.4

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


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23ECP518

BODY AREA NETWORKS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the BAN architecture, health care and its challenges.
- To discuss the hardware requirement of BAN.
- To explain the communication and security aspects in the BAN.
- To describe the Intrinsic – Extrinsic issues of BAN.
- To gain knowledge on applications of BAN in the field of medicine.

UNIT I INTRODUCTION

9

Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BAN Architecture – Introduction.

UNIT II HARDWARE FOR BAN

9

Processor-Low Power MCUs, Mobile Computing MCUs ,Integrated processor with radio transceiver, Memory ,Antenna-PCB antenna, Wire antenna, Ceramic antenna, External antenna, Sensor Interface, Power sources- Batteries and fuel cells for sensor nodes.

UNIT III WIRELESS COMMUNICATION AND NETWORK

9

RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology- Stand –Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1,IEEE P802.15.13, IEEE 802.15.14, Zigbee.

UNIT IV COEXISTENCE ISSUES WITH BAN

9

Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self-protection-Bacterial attacks, Virus infection, Secured protocols, Self-protection.

UNIT V APPLICATIONS OF BAN

9

Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

TOTAL: 45PERIODS



OUTCOMES

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

- Analyze the significance and role body area networks in the present contemporary world.
- Design a BAN for appropriate application in medicine.
- Analyze the efficiency of communication and the security parameters.
- Develop the medical device regulation and regulations followed in various regions.
- Implement the concepts of BAN for medical applications.

TEXTBOOKS

1. Sandeep K.S. Gupta, Tridib Mukherjee, Krishna Kumar Venkata Subramanian, "Body Area Networks Safety, Security, and Sustainability", Cambridge University Press, 2013.
2. Mehmet R. Yuce, Jamil Y. Khan, "Wireless Body Area Networks Technology, Implementation, and Applications", Pan Stanford Publishing Pte. Ltd., Singapore, 2012.

REFERENCES

1. Zhang, Yuan-Ting, "Wearable Medical Sensors and Systems", Springer, 2013.
2. Annalisa Bonfiglio, Danilo De Rossi, "Wearable Monitoring Systems", Springer, 2011.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/106/105/106105160>
2. <http://www.cs.iit.edu/winet/projects/wban.html>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	2	2	1	1	1	1	1	-	-	-	1	3	3
2	3	3	3	3	1	2	2	-	-	-	1	3	3
3	3	2	1	1	1	1	1	-	-	-	1	3	3
4	2	2	1	1	1	1	1	-	-	-	1	3	3
5	2	2	1	1	1	2	2	-	-	-	1	3	3
AVG	2.4	2.2	1.4	1.4	1	1.4	1.4	-	-	-	1	3	3

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


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PROFESSIONAL ELECTIVE IV

23ECP601

RF TRANSCEIVERS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of RF system design.
- To inculcate the various components of RF system for wireless communications
- To summarize basic techniques needed for analysis of RF systems.
- To obtain the knowledge on basic principles and design aspects involved in RF systems components.
- To familiarize students on noise behavior, and design principles of PLLs and frequency synthesizers including Integer-N and DDS architectures.

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES CMOS: 9

Introduction to MOSFET Physics - Noise: Thermal, shot, flicker, popcorn noise - Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR - Phase noise - Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low-IF Architectures - Transmitter: Direct-up conversion, Two-step up conversion schemes

UNIT II IMPEDANCE MATCHING NETWORKS AND AMPLIFIERS 9

Review of S-parameters and Smith chart - Passive IC components - Impedance matching networks - Amplifiers: Common Gate, Common Source Amplifiers - OC Time constants in bandwidth estimation and enhancement - High frequency amplifier design - Low Noise Amplifiers: Power match and Noise match, single-ended and differential LNAs

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS 9

Feedback Systems: Stability of feedback systems, Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations, Compensation - Power Amplifiers: General model - Class A, AB, B, C, D, E and F amplifiers - Linearization Techniques - Efficiency boosting techniques - ACPR metric 125

UNIT IV FILTERS, OSCILLATORS AND MIXERS 9

Overview - basic resonator and filter configuration, special filter realizations, filter implementation - Basic oscillator model, high-frequency oscillator configuration, Colpitt's oscillator - basic characteristics of mixers, single and double-balanced mixers

UNIT V PLL AND FREQUENCY SYNTHESIZERS PLL: 9

Linearized Model, Noise properties, Phase detectors, Loop filters and Charge pumps Frequency Synthesizers: Integer-N frequency synthesizers - Direct Digital Frequency Synthesizers .

TOTAL: 45 PERIODS



OUTCOMES

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

- Explain the architecture and features of 8051 Interpret the nonlinear effects in RF circuits.
- Design RF circuits for common source Amplifiers.
- Analyze the performance of RF circuits and Linearization Techniques.
- Design basic filter structures, oscillator circuits, and mixer configurations for high-frequency applications.
- Analyze PLL components, evaluate noise performance, and design basic frequency synthesizer systems.

TEXT BOOKS

1. Lee T, "Design of CMOS RF Integrated Circuits", Cambridge, Second Edition, 2004.
2. Razavi B, "RF Microelectronics", Pearson Education, Second Edition, 2012.

REFERENCES

1. Razavi B, "Design of Analog CMOS Integrated Circuits", McGraw Hill, Second Edition, 2017
2. Kyung-WhanYeom, "Microwave Circuit Design - A Practical Approach using ADS", Pearson Education, 2015

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_ee75/preview - (RF Transceiver Design).
2. <https://terna.digimat.in/nptel/courses/video/108107379/L55.html/> - (RF Transceiver of Design – Electrical Engineering).

Mapping of COs-POs & PSOs

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

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


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23ECP602

SIGNAL INTEGRITY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the characteristic impedance of transmission line and impedance matching techniques.
- To inculcate the mechanisms, types, and causes of crosstalk noise in transmission lines.
- To gain knowledge on differential signaling concepts, advantages, and termination methods for high-speed circuits.
- To acquire insights in to Jitter analysis and jitter decomposition.
- To gain knowledge on jitter types, jitter decomposition, and eye-diagram-based signal integrity measurements.

UNIT I SIGNAL REFLECTION AND IMPEDANCE MATCHING TECHNIQUE

9

Phenomenon of signal reflection. Signal reflection at transmitting end. Signal reflection at branch point. Multiple reflection in transmission line. Prevention of signal reflection by using impedance matching technique.

UNIT II CROSSTALK NOISE

9

Crosstalk definition and classification. Crosstalk mechanism. Analysis of crosstalk noise in transmission line. Main factor of causing crosstalk noise.

UNIT III DIFFERENTIAL SIGNAL TRANSMISSION CIRCUIT.

9

Pros and cons of using differential signaling compared with that of single-ended signaling. High-speed differential interfaces. Theory of differential signaling. Differential signal termination techniques.

UNIT IV FREQUENCY RESPONSE OF A CIRCUIT

9

Frequency response of transmission line and circuit. Inter-symbol interference (ISI) and eye-pattern. Deterioration of a signal waveform due to ISI. Circuit techniques to prevent the deterioration. Linear time-invariant systems. Frequency response of pulse.

UNIT V EYE DIAGRAM AND JITTER

9

Jitter Definition and Types of Jitter; Jitter decomposition; Eye diagram analysis and related measurement

TOTAL: 45 PERIODS



UTCOMES

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

- Analyze reflection phenomena and design proper impedance-matched transmission systems.
- Discuss the crosstalk sources and evaluate crosstalk noise levels in communication circuits.
- Design differential and single-ended transmission circuits with proper termination.
- Implement the eye patterns and circuit techniques to minimize ISI effects.
- Analyze jitter decomposition and signal integrity using eye diagrams.

TEXT BOOKS

1. Eric Bogatin, "Signal and Power integrity", Pearson, Third Edition, 2018.
2. Howard Johnson and Martin Graham, "High Speed Digital Design", Prentice Hall, First Edition, 1993.

REFERENCES

1. Howard Johnson, "High Speed Signal Propagation", Prentice Hall, First Edition, 2000.
2. Howard Johnson and Martin Graham, "High Speed Digital Design", 2011.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_ee67/preview - (Signal integrity: Principles, Techniques and Applications).
2. <https://nptel.ac.in/courses/108105187> - (VLSI Interconnects).

Mapping of COs-POs & PSOs

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

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


Chairman - BOS

23ECP603

ANTENNAS AND WAVE PROPAGATION

L T P C

3 0 0 3

OBJECTIVES

- To describe the fundamentals of Antenna.
- To inculcate the operating principles of various antennas.
- To impart knowledge on antenna array.
- To introduce the concept of special antennas and measurement of various parameters.
- To explain the mechanism and models for radio-wave propagation.

UNIT I FUNDAMENTALS OF RADIATION

9

Definition of antenna parameters - Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching - Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole, Folded dipole, Yagi array.

UNIT II APERTURE AND SLOT ANTENNAS

9

Radiation from rectangular apertures, Uniform and Tapered aperture, Frequency independent antennas, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas, Microstrip antennas - Radiation mechanism - Application, Numerical tool for antenna analysis.

UNIT III ANTENNA ARRAYS

9

Linear element linear array, Pattern multiplication, Broadside and End fire array - Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV SPECIAL ANTENNAS

9

Principle of frequency independent antennas - Spiral antenna, Helical antenna, Log periodic. Modern antennas - Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure and applications, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR.

UNIT V PROPAGATION OF RADIO WAVES

9

Modes of propagation, Structure of atmosphere, Ground wave propagation, Tropospheric propagation, Duct propagation, Troposcatter propagation, Sky wave propagation-Virtual height, critical frequency, Maximum usable frequency-Skip distance, Fading, Multi hop propagation.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Explain the basic principles of antenna and input impedance.
- Apply the concepts of uniform and tapered aperture to classify different types of antennas.
- Analyze the principles and characteristics of antenna arrays.
- Analyze the operation of special antennas and their applications.
- Identify the characteristics of radio-wave propagation and sky wave propagation.

TEXT BOOKS

1. John D Kraus, "Antennas for all Applications", Mc Graw Hill, Third Edition, 2005.
2. Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006

REFERENCES

1. Robert A.Monzingo, Randy L. Haupt and Thomas W.Miller, "Introduction to Adaptive arrays", IET, Second Edition, 2011.
2. S. Drabowitch, "Modern Antennas", Springer Publications, Second Edition ,2007.

E-RESOURCES

1. <https://archive.nptel.ac.in/courses/108/101/108101092/> - (Antennas).
2. <https://archive.nptel.ac.in/courses/117/107/117107035/> - (Advanced Antenna Theory).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	1	-	-	-	1	1	3	2
2	3	3	3	3	3	-	-	-	-	2	1	3	2
3	3	3	3	3	3	1	-	-	-	2	1	3	2
4	3	3	3	3	3	1	-	-	-	1	1	3	2
5	3	3	3	3	3	-	-	-	-	2	1	3	2
AVG	3	3	3	3	3	1	-	-	-	1.6	1	3	2

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

(Signature)
Chairman - BoS





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23ECP604

MICs AND RF SYSTEM DESIGN

L T P C
3 0 0 3

OBJECTIVES

- To introduce the characteristics of Active components and applications.
- To describe the RF filter operated at millimeter wavelength.
- To inculcate the basics of Microwave integrated circuits.
- To expose the concepts of non reciprocal components for MICs.
- To impart knowledge on antenna and its performance using measurement techniques

UNIT I ACTIVE RF COMPONENTS AND APPLICATIONS

9

RF diodes, BJT, RF FET'S, High electron mobility transistors, matching and biasing networks, impedance matching using discrete components, microstripline matching networks, amplifier classes of operation and biasing networks.

UNIT II RF FILTER DESIGN

9

Overview, Basic resonator and filter configuration, special filter realizations, smith chart based filter design, coupled filter.

UNIT III INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS

9

Overview of ABCD and S parameters - Overview of Planar transmission lines (Stripline, Microstripline, Slotline, CPW, Finline)-Design Parameters for Strip Line And Microstripline- Active Device Technologies- Design Approaches Multichip Module Technology- Substrates.

UNIT IV NON RECIPROCAL COMPONENTS FOR MICs

9

Microstrip on Ferrimagnetic substrates, Microstrip circulators. Isolators and phase shifters, Design of microstrip circuits – high power and low power circuits.

UNIT V INTEGRATED ANTENNA DESIGN AND MEASUREMENTS

9

Integrated Antenna Design- Photonic Band Gap Antennas - Micro Machined Antenna - Micro Electro Mechanical System Antennas - Test Fixture Measurements - Probe Station Measurements - Thermal and Cryogenic Measurements- Experimental Field Probing Techniques.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Design appropriate matching and biasing networks for RF amplifier applications.
- Apply RF filters using resonator structures, Smith chart techniques, and coupled-line configurations.
- Analyze microwave integrated circuits using ABCD/S-parameters and evaluate planar transmission line structures and substrates.
- Design non-reciprocal microwave components such as circulators, isolators, and phase shifters.
- Design integrated antennas and perform essential RF and microwave measurement techniques.

TEXT BOOKS

1. Reinhold Ludwig and Powel Bretchko, "RF Circuit Design – Theory and Applications", Pearson Education Asia, First Edition, 2001.
2. Bharathi Bhat, Shibani K. Koul, "Stripline-like Transmission Lines for Microwave Integrated Circuits", New Age International Pvt Ltd Publishers, 2007.

REFERENCES

1. Mathew M. Radmanesh, "Radio Frequency & Microwave Electronics", Pearson Education Asia, Second Edition, 2002.
2. David Pozar, "Microwave Engineering", Addison Wesley Third Edition, 2004.

E-RESOURCES

1. <https://nptel.ac.in/courses/117102012> - (RF system basic architectures).
2. <https://kongunadu.digimat.in/nptel/courses/video/117102012/L01.html> - (RF Integrated Circuits).

Mapping of COs-POs & PSOs

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

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

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23ECP605

EMI/EMC PRE COMPLIANCE TESTING

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic concepts of Electromagnetic Interference.
- To expose the importance of measurement device for EMI.
- To summarize basic antenna parameters for EMI coupling & control principles.
- To inculcate the basics of receivers & Analyzer functionality.
- To impart knowledge on design issues in EMI/EMC.

UNIT I NATURE AND ORIGINS OF ELECTROMAGNETIC COMPATIBILITY

9

Introduction-Visualising the EMI problem-Source of EMI, EMI coupling to victim equipment, Intersystem and Intrasystem EMI, EMC standards and specifications.

UNIT II TYPES of EMI COUPLING

9

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling, Near field cable to cable coupling; Field to cable coupling, Power mains and Power supply coupling; Transient EMI

UNIT III MEASUREMENT DEVICES FOR EMI

9

Introduction – Measurement by direct connection, Inductively coupled devices, EMC antennas – Basic antenna parameters, Antennas for radiated emission testing, Wideband antennas - Magnetic field antennas, Type of antennas used in susceptibility testing

UNIT IV RECEIVERS, ANALYSERS AND MEASUREMENT EQUIPMENT

9

EMI receiver, Spectrum Analyzers, RF power meter Frequency meters. Standards requiring immunity tests, Automatic EMC tests, Electromagnetic transient testing, Transient types, Continuous and transient signal, ESD-electrostatic discharge

UNIT V PRE-COMPLIANCE TESTING TO AVOID EMC PROBLEMS

9

Need for Pre-Compliance Testing; Intersystem and Intrasystem EMC - Developing an approach to EMC design - Process flow chart, - EMC strategy – Self certification; Solutions to avoid EMC: ESD Shielding, EMI Filters; Grounding; Bonding, Isolation transformer, Transient suppressors; EMI Suppression Cables.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the various types and mechanisms of Electromagnetic Interference.
- Design a suitable EMI mitigation technique in differential mode coupling.
- Discuss EMI coupling & control principles.
- Explain the importance receivers & Analyzer functionalities.
- Design issues in compliance testing and EMI/EMC.

TEXTBOOKS

1. Mark I. Montrose, Edward M. Nakauchi, "Testing for EMC Compliance: Approaches and Techniques", Wiley-IEEE Press, First Edition, 2004.
2. Henry W. Ott, "Electromagnetic Compatibility Engineering", 2021

REFERENCES

1. Tim Williams, "EMC for Product Designers" Newnes; Fifth edition, 2016.
2. Mark I. Montrose, "Printed Circuit Board Design Techniques for EMC Compliance", Wiley-IEEE Press; Second Edition, 2000.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc24_ee67/preview - (EMI /EMC and Signal Integrity: Principles, Techniques and Applications).
2. <https://archive.nptel.ac.in/courses/108/106/108106138/> - (Electromagnetic Compatibility)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	1	-	-	1	-	1	2	1
2	3	3	3	3	3	2	-	-	1	-	2	2	2
3	3	3	3	3	3	2	-	-	1	-	2	2	2
4	3	3	3	3	3	2	-	-	1	-	2	2	1
5	3	3	3	3	3	2	-	-	1	-	2	2	2
AVG	3	3	3	3	3	2	-	-	1	-	2	2	1.6

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


Chairman - BoS





23ECP606

RFID SYSTEM DESIGN AND TESTING

L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamentals of near field and far field RFID communications.
- To inculcate the standards and protocols used in RFID systems.
- To discuss the operating principles of RFID tag and reader.
- To introduce the security aspects and system architecture of RFID systems.
- To expose the industrial and scientific applications of RFID systems.

UNIT I INTRODUCTION

9

RFID Principles: Near-field based RFID – Properties of Magnetic field – Far-field based RFID – Properties of Backscatter RF Systems – Modulation techniques – Frequency based property comparison of RFID Systems.

UNIT II RFID STANDARDS AND PROTOCOLS

9

RFID Industry standards: EPC global – ISO15693 Vicinity cards and RFID – ISO14443 Proximity cards and RFID – The NFC forum – Reading collocated RFID tags: Query Tree protocol – Query Slot protocol.

UNIT III OPERATING PRINCIPLES

9

RFID Tag components: RFID tag types – the 1-Bit Transponder and Chipless Tags – RFID readers and middleware component – Communication fundamentals: Coupling, Data encoding, multi-path effect – Tag, Reader and sensor communication.

UNIT IV DATA INTEGRITY AND SECURITY

9

The checksum procedure – Multiaccess procedures – Attacks on RFID Systems – Protection by Cryptographic measures.

UNIT V RFID ENABLED SENSORS AND APPLICATIONS

9

RFID enabled Sensors: Antenna design challenges – IC design – Integration of sensors and RFID – Power consumption and Link budget.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Classify RFID systems based on frequency, architecture and performance.
- Discuss the standards for RFID technology.
- Analyze the operation of various components of RFID systems.
- Describe the privacy and security issues in RFID Systems.
- Discuss the construction and applications of RFID enabled sensor.

TEXTBOOKS

1. V. Daniel Hunt, Albert Puglia B.A., M.A., Mike Puglia B.S., "RFID-A Guide to Radio Frequency Identification", 2006.
2. Amin Rida, Li Yang, Manos M. Tentzeris, "RFID Enabled Sensor Design and Applications", Artech House, 2010

REFERENCES

1. Paris Kitsos, "Security in RFID and Sensor Networks", CRC Press, 2016
2. Klaus Finkenzeller, "RFID Handbook", Wiley, Third Edition 2010

E-RESOURCES

1. <https://nptel.ac.in/courses/108108123> - (Advanced IOT Applications).
2. <https://archive.nptel.ac.in/courses/108/108/108108179/> - (Design of Internet of Things)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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PROFESSIONAL ELECTIVE V

23ECP607

ROCKETRY AND SPACE MECHANICS

L T P C
3 0 0 3

OBJECTIVES

- To introduce the fundamental aspects of rocket motion along with detailed estimation of rocket trajectories.
- To impart knowledge on optimization of multistage rockets.
- To gain the knowledge on basics of space mechanics required for an aeronautical student.
- To expose the basics of orbit transfer of satellites.
- To gain the knowledge on various control methods of rockets.

UNIT I ORBITAL MECHANICS

9

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points – Estimation of orbital and escape velocities.

UNIT II SATELLITE DYNAMICS

9

Geosynchronous and geostationary satellites- factors determining life time of satellites – satellite perturbations – orbit transfer and examples –Hohmann orbits – calculation of orbit parameters– Determination of satellite rectangular coordinates from orbital elements.

UNIT III ROCKET MOTION

9

Principle of operation of rocket motor – thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories – determinations of range and altitude – simple approximations to burnout velocity.

UNIT IV ROCKET AERODYNAMICS

9

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, form drag and base pressure drag – Boat-tailing in missiles – performance at various altitudes – rocket stability – rocket dispersion – launching problems.

UNIT V STAGING AND CONTROL OF ROCKET VEHICLES

9

Need for multi staging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles – SITVC.

TOTAL: 45 PERIODS





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OUTCOME

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

- Analyze the fundamental laws of orbital mechanics with particular emphasis on interplanetary trajectories.
- Design the geocentric or interplanetary missions.
- Discuss trajectory calculations for planar motion of rockets.
- Describe forces and moments acting on airframe of a missile.
- Explain the need for staging and stage separation dynamics of rocket vehicles.

TEXTBOOKS

1. Carla Mooney, "ROCKETRY: Investigate the Science and Technology of Rockets and Ballistics", 2014.
2. Don Edberg and Willie Costa, "Design of Rockets and Space Launch Vehicles (Aiaa Education)", 2023.

REFERENCES

1. Suresh. B N & Sivan. K, "Integrated Design for Space Transportation System", Springer India, 2015.
2. Sutton, GP, John Wiley & Sons Inc. "Rocket Propulsion Elements", New York, Eight Edition, 2010.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_ae01/preview - (Rocket Propulsion)
2. https://onlinecourses.nptel.ac.in/noc19_ae08/preview - (Introduction to Rocket Propulsion)

Mapping of COs-POs & PSOs

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

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


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23ECP608

WIRELESS SENSOR NETWORK DESIGN

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of wireless sensor network.
- To gain knowledge on the MAC and Routing Protocols of WSN.
- To impart knowledge on 6LOWPAN technology.
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.
- To familiarize students in operating system related to WSN and 6LOWPAN.

UNIT I INTRODUCTION

9

Principle of Wireless Sensor Network -Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards-IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT II MAC AND ROUTING PROTOCOLS

9

MAC protocols – fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC, TRAMA, Routing protocols – Requirements, Classification -SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT III 6LOWPAN

9

LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers – Addressing, Routing - MeshUnder - Route-Over, Header Compression - Stateless header compression - Context- based header compression, Fragmentation and Reassembly, Mobility – types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO –Routing – MANET, ROLL, Border routing.

UNIT IV APPLICATION

9

Design Issues, Protocol Paradigms -End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols -Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP), Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry-Specific protocols.

UNIT V TOOLS

9

TinyOS – Introduction, NesC, Interfaces, modules, configuration, Programming in TinyOS using NesC, TOSSIM, Contiki – Structure, Communication Stack, Simulation environment – Cooja simulator, Programming

TOTAL: 45PERIODS





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OUTCOMES

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

- Explain the Zigbee and Bluetooth for WSNs applications.
- Discuss the efficient MAC and Routing Protocols.
- Design solutions for 6LOWPAN applications.
- Discribe efficient layered protocols in 6LOWPAN.
- Analyze Tiny OS and Contiki OS in WSNs and 6LOWPAN applications.

TEXTBOOKS

1. Anna Forster, "Introduction to Wireless Sensor Networks", Wiley, 2017.
2. Shuang-Hua Yang, "Wireless Sensor Networks: Principles, Design and Applications ", Kindle Edition, 2013.

REFERENCES

1. Zach Shelby Sensinode and Carsten Bormann, " 6LoWPAN: The Wireless Embedded Internet" John Wiley and Sons, Ltd, Publication, 2009.
2. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley Publication, 2006.

E-RESOURCES

1. [https://archive.nptel.ac.in/courses/106/105/106105160/-](https://archive.nptel.ac.in/courses/106/105/106105160/) (Wireless ad Hoc and sensor networks).
2. <https://nptel.ac.in/courses/117104118> (Principles of Signal Estimation for MIMO/ OFDM Wireless Communication).

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	1	-	-	-	2	2	3	1
2	3	3	2	2	2	1	-	-	-	-	2	3	2
3	3	3	3	2	2	1	-	-	-	-	3	3	2
4	3	3	3	3	2	2	-	-	-	-	2	2	1
5	2	-	1	1	3	2	-	-	-	-	2	2	2
AVG	2.8	3	2.2	2	2.2	1.4	-	-	-	2	2.2	2.6	1.6

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


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23ECP609

INDUSTRIAL IOT 4.0

L T P C
3 0 0 3

OBJECTIVES

- To discuss the basic knowledge of Industry 4.0.
- To introduce the IoT architecture and its characteristics.
- To expose physical devices and controlling hardware in IoT.
- To familiarize students in IoT development of sensors.
- To obtain in depth knowledge on IoT with communication protocol.

UNIT I BASICS OF INDUSTRY 4.0

9

Industry 4.0 Basics: Industrial revolution: Phases, Evolution of Industry4.0, Environmental impacts of industrial revolution, Applications, Design requirements, Drivers of Industry4.0, Sustainability Assessment of industries, Smart Business Perspective, Cyber security, Impacts of Industry 4.0.

UNIT II IIOT ARCHITECTURE

9

Industrial Internet of Things- Basics: IIoT and Industry 4.0, IIC, Industrial Internet Systems, Design of industrial internet systems, Impact of industrial internet, Benefits of industrial internet, Industrial sensing, Industrial Processes, Features of IIoT for industrial processes, Industrial plant-The future architecture, Digital Enterprise Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IIoT, Industrial Internet Reference Architecture

UNIT III SMART IOT HARDWARES

9

On-site Technologies, Augmented Reality, Virtual Reality, Smart factories, Lean manufacturing system, Big Data and Advanced Analytics

UNIT IV SENSORS USED IN IOT DEVELOPMENT

9

Sensors: Various sensor types and their underlying working principles, Characteristics of Sensors – Resolution, calibration, accuracy and others, Sensor Categories – Thermal, Mechanical, Electrical, Optical and Acoustic sensors. Actuators: Thermal, Hydraulic, Pneumatic, Electro mechanical Actuator

UNIT V CHALLENGES IN IOT SYSTEM DESIGN IN COMMUNICATION PROTOCOLS

9

Industrial Data Transmission and Acquisition: Architecture of various data transmission technologies like Foundation Fieldbus, Profibus, Highway Addressable Remote Transducer (HART), Inter bus, Bit bus, Digital STROM, Controller Area Network, and other recent and upcoming Technologies. Distributed Control System, SCADA and PLC System. IOT Applications: IoT Applications on Industrial automation, Factories and Assembly line, Plant Security and Safety, Transportation, Agriculture, Healthcare, Home Automation, Oil, Chemical and Pharmaceutical Industry and others.

TOTAL:45 PERIODS





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OUTCOMES

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

- Explain the concepts, evolution, and applications of Industry 4.0 in modern engineering systems.
- Describe the architecture, characteristics, and components of Internet of Things (IoT) systems.
- Apply the interfacing and control of IoT physical devices and hardware components using appropriate platforms.
- Examine IoT-based sensor interfacing applications for data acquisition and monitoring.
- Analyze the performance and suitability of various IoT communication protocols for different application

TEXTBOOKS

1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
2. Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014.

REFERENCES

1. Simon Monk, O'Reilly (SPD), "Raspberry Pi Cookbook - Software and Hardware Problems and solutions", 2016,
2. N. Ida, "Sensors, Actuators and their Interfaces", SciTech Publishers, 2014.

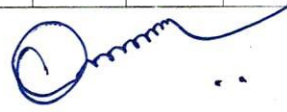
E-RESOURCES

1. <https://archive.nptel.ac.in/courses/106/105/106105166/> (Introduction to IoT)
2. https://onlinecourses.nptel.ac.in/noc20_cs69/preview (Introduction to Industry 4.0 and Industrial Internet of Things)

Mapping of COs-POs & PSOs

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

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


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23ECP610

FUNDAMENTALS OF NANOELECTRONICS

L T P C

3 0 0 3

OBJECTIVES

- To introduce quantum principles and nanoscale phenomena governing electron behavior in nanoelectronic.
- To describe quantum electronic devices and their operation based on nanoscale mechanisms.
- To inculcate nanoelectronic transistors and Coulomb blockade effects in various nanoscale device structures.
- To expose tunneling phenomena and superconducting devices used in ultra-low-power nanoelectronics.
- To enhance knowledge on properties, fabrication, and device applications of carbon nanotubes.

UNIT I INTRODUCTION TO NANO ELECTRONICS

9

Scaling to nano - Light as a wave and particle- Electrons as waves and particles- origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation- Electron confinement - Quantum dots, wires and well-Spin and angular momentum

UNIT II QUANTUM ELECTRONICS

9

Quantum electronic devices - Short channel MOS transistor- Drain Induced Barrier Lowering, Velocity Saturation, Hot carrier injection - Split gate transistor - Electron spin transistor - Quantum cellular automata -Quantum dot array, Quantum memory.

UNIT III NANO ELECTRONIC TRANSISTORS

9

Coulomb blockade - Coulomb blockade in Nano capacitors - Coulomb blockade in tunnel junctions - Single electron transistors, Semiconductor nanowire FETs and SETs, Molecular SETs and molecular electronics - Memory cell.

UNIT IV NANO ELECTRONIC TUNNELING AND SUPER CONDUCTING DEVICES

9

Tunnel effect -Tunneling element -Tunneling diode - Resonant tunneling diode - Three terminal resonant tunneling devices- Superconducting switching devices- Cryotron- Josephson tunneling device.

UNIT V NANOTUBES AND NANOSTRUCTURE DEVICES

9

Carbon Nanotube - Fullerenes - Types of nanotubes - Formation of nanotubes -Assemblies - Purification of carbon nanotubes - Electronic properties - Synthesis of carbon nanotubes - Carbon nanotube interconnects - Carbon nanotube FETs and SETs -Nanotube for memory applications- Nano structures and nano structured devices.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Design various quantum electronic devices based on wave, spin, and nanoscale.
- Design nanoelectronic transistors and Coulomb blockade concepts in advanced nanoscale device.
- Analyze the key performance aspects of tunneling and superconducting nano electronic devices.
- Discuss tunneling phenomena and the operation of superconducting nano-devices
- Describe the applications of carbon nanotubes and nanostructured materials in nanoelectronics.

TEXTBOOKS

1. Hanson, "Fundamentals of Nanoelectronics", Pearson education, 2009.
2. Robert Puers, Livio Baldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten, "Nanoelectronics: Materials", Devices, Applications, Wiley, 2017.

REFERENCES

1. Mircea Dragoman and Daniela Dragoman, "Nanoelectronics: Principles and Devices", Artech House, 2009.
2. Brajesh Kumar Kaushik, "Nanoelectronics: Devices, Circuits and Systems", Elsevier science, 2018.

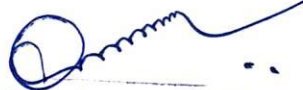
E-RESOURCES

1. <https://nptel.ac.in/courses/117108047> - Nanoelectronics: Devices and Materials
2. https://onlinecourses.nptel.ac.in/noc22_ee47/preview - Physics of Nanoscale Devices

Mapping of COs-POs & PSOs

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

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


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23ECP611

UNDERWATER COMMUNICATION

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals, design, characteristics, and handling of fibre optic systems and electro-optical cables.
- To inculcate underwater wireless optical communication systems, including modulation, channel modeling.
- To enhance the knowledge on magnetic induction-based underwater communication principles, system components.
- To impart knowledge of the underwater acoustic environment, sound propagation, channel characteristics.
- To familiarize students with underwater acoustic networking technologies, modems, protocols, applications

UNIT I UNDERWATER FIBRE OPTICS COMMUNICATION

9

Basics of Fibre Optics communication: Working Principle, Single Mode, Multi-Mode, Effect on Fibre bending, Standard FO Connectors, Cable Requirement for Underwater Application, Cable Characteristics, Basic design for Electro-Optical(E-O) Underwater Cable, Handling system for E-O cables, Optical slip ring and its application, An insight into Fibre Optic Telemetry.

UNIT II UNDERWATER OPTICAL COMMUNICATION

9

Introduction, Classification of Underwater Wireless Optical Communication Links, Underwater Optical Communication (UWOC) System: Modulation, Coding, Light Source Technology, Common Lasers in UWOC, Signal Detectors and its merits and demerits, Alignment and Compensation, UWC Network, Absorption and Scattering Losses, UWOC Channel Modeling, UWOC Link Turbulence, Noise in the UWOC Channel. UWOC Networks.

UNIT III UNDERWATER MI COMMUNICATION & SENSOR NETWORKS

9

Fundamental Principles of Magnetic Induction, Basic Element of Magnetism, Magnetic Induction, Lenz's Law, Mutual and Self Induction, Inductive and Capacitive Reactance of the coil, MI Communication System: MI Coil, Matching Network, Communication Block:

MI Wireless Sensor Networks: UW sensor network Application and Its Architecture, Localization, Medium Access protocols, Routing Protocols, Cross-layer Protocols, Recent trend on MI communication.

UNIT IV BASIC PRINCIPLES OF UNDERWATER ACOUSTIC COMMUNICATION

9

Ocean Acoustic environment; Measuring sound levels and relevant units; Sound propagation in the ocean – sound velocity profiles in the deep water and shallow water Speed of underwater sound, Underwater Sound Transmission Loss, Acoustic Field Model: Ray Theory Model, Structure and Performance of UWAC System: Basic Structure of UWAC System, Performance Indicators of UWAC System, Characteristics of the UWA Channel.

UNIT V UNDERWATER ACOUSTIC NETWORK TECHNOLOGY

9





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Basics on Underwater Acoustic Modem and its construction, Bandwidth and its limitations, Characteristics of UWA Network, Topology of UWA Network, Network Protocol Architecture of UWA Network, UWAC Challenges and Research Trends, Comparison study on RF, Optical and Acoustic Communication in Underwater. Underwater telephone, Acoustic Positioning System, Underwater beacon

TOTAL: 45 PERIODS

OUTCOMES

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

- Design basic electro-optical (E-O) underwater cable systems and handling mechanisms.
- Analyze underwater wireless optical communication links and systems.
- Impact knowledge on recent trends and applications of MI communication in underwater environments.
- Apply limitations of underwater acoustic communication systems.
- Analyze underwater acoustic network topologies and protocol architectures.

TEXTBOOKS

1. Yi Lou, Niaz Ahmed, "Underwater Communications and Networks", First Edition, Springer, 2021.
2. Robert J Urick, "Principles of underwater sound", Peninsula Publishing, Third Edition, 2013

REFERENCES

1. L.M. Brekhovskikh and Yu. P. Lysanov, "Fundamentals of ocean acoustics", Springer, Third Edition, 2003.
2. Rahul Sharma, "Deep Sea Mining Handbook", Springer, First Edition, 2017.

E-RESOURCES

1. <https://nptel.ac.in/courses/106105160?> - Wireless Ad Hoc and Sensor Networks
2. https://onlinecourses.nptel.ac.in/noc23_ee61/preview? - Optical Wireless Communications for Beyond 5G Networks and IoT

Mapping of COs-POs & PSOs

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4	3	3	3	3	3	3	-	-	-	-	1	3	2
5	3	3	3	3	3	3	-	-	-	-	1	3	2
AVG	3	3	3	3	2	3	-	-	-	-	1	2	2

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

Chairman - BoS





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23ECP612

OCEAN ACOUSTICS

L T P C
3 0 0 3

OBJECTIVE

- To introduce the concept of ocean acoustics for marine applications.
- To expose acoustic transduction principles, SONAR transducer design, array geometries.
- To impact the characteristics, frequency bands, and variability of natural, biological, and man-made underwater noises.
- To gain knowledge on underwater acoustic signal and spectral analysis, filtering.
- To familiarize students with various underwater acoustic instruments, sonar systems, positioning technologies.

UNIT I FUNDAMENTALS OF UNDERWATER ACOUSTICS

9

Ocean Acoustic environment; Measuring sound levels and relevant units; Sound propagation in the ocean – sound velocity profiles in the deep water and shallow water; Sound attenuation in the sea – absorption, scattering, transmission loss, reverberation, Snell's law, target strength; SONAR systems- active, passive SONAR equations and system parameters.

UNIT II UNDERWATER ACOUSTIC TRANSDUCERS AND DEVICES

9

Principles of transduction and SONAR transducer design; Electromechanical Analog circuits, coupling coefficient, efficiency, Directivity characteristics of receivers, frequency response characteristics of transducers, Transducer measurement techniques; Physical geometry of arrays - linear, planar, cylindrical, spherical, beam patterns, array gain.

UNIT III AMBIENT NOISE IN THE OCEAN

9

Sources of noise, Natural and Physical sounds - Seismic, Wind, Wave, Rain and Turbulence; Biological sounds - Dolphin, Whales, Fishes; Man made Noises- Shipping Machinery noises, Pile driving, Wind Mills; Variability of Ambient noises; Frequency Bands, Noise levels of all above; Impacts of Sound on Marine Animals.

UNIT IV PROCESSING OF UNDERWATER ACOUSTIC SIGNALS AND IMAGES

9

Representations of the signals – Fourier representations, Spatial filtering; Matched filters and Autocorrelations, Temporal resolution; Signal to Noise Ratio, Estimation of Auto Covariance, Cross Covariance; Power spectra of different Underwater Signals, Classification of signals; Concept and Types of beamforming techniques; Image segmentation, Filtering, Equalization and Restoration

UNIT V UNDERWATER ACOUSTIC INSTRUMENTS AND ITS APPLICATION

9

Principles of Sonar systems, Echosounder – single beam, multi beam; Side scan sonars – Imaging, Underwater acoustic camera; Sub bottom profilers – Sediment classification; Acoustic modem – Tsunami systems; Acoustic Positioning system- Transponders, USBL, SSBL systems, HiPAP; Underwater telephone; Underwater noise recorders; Underwater Beacons.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Describe the ocean acoustic environment and methods of measuring underwater sound levels.
- Discuss different array geometries and interpret beam patterns and array gain.
- Implement natural, biological, and man-made sources of underwater noise.
- Apply covariance and power spectra for different underwater signals.
- Examine practical applications of underwater acoustic instruments in ocean exploration.

TEXTBOOKS

1. Robert J Urick, "Principles of underwater sound", Peninsula Publishing, Third Edition, 2013.
2. John G Proakis and Manolakis, "Digital Signal Processing Principles Algorithms and Applications", Pearson, Fourth Edition, 2006.

REFERENCES

1. L.M. Brekhovskikh and Yu. P. Lysanov, "Fundamentals of ocean acoustics", Springer, Third Edition, 2003.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Gatesmark Publishing, Third Edition, 2020.

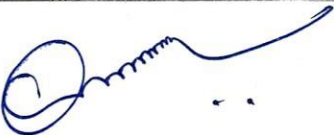
E-RESOURCES

1. <https://nptel.ac.in/courses/112104212?> - Fundamentals of Acoustics
2. https://onlinecourses.nptel.ac.in/noc24_me106/preview? - Fundamentals of Acoustics

Mapping of COs-POs & PSOs

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

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


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PROFESSIONAL ELECTIVE VI

23ECP613

WIRELESS BROAD BAND NETWORKS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of mobile networking and IP mobility.
- To expose the channel allocation and interference mitigation techniques.
- To inculcate IP addressing mechanisms such as DHCP in mobile environments.
- To obtain knowledge on MAC layer operations, scheduling services, and random access procedures.
- To familiarize students in 5G roadmap and core pillars of next-generation mobile networks.

UNIT I WIRELESS PROTOCOLS

9

Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer-Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements- Indirect TCP, snooping TCP, Mobile TCP.

UNIT II 3G EVOLUTION

9

IMT-2000 - W-CDMA, CDMA 2000 - radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN - architecture, High Speed Packet Data-HSDPA, HSUPA.

UNIT III 4G EVOLUTION

9

Introduction to LTE-A - Requirements and Challenges, network architectures - EPC, E- UTRAN architecture - mobility management, resource management, services, channel -logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT IV LAYER-LEVEL FUNCTIONS

9

Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme - frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation - CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services.

UNIT V 5G EVOLUTION

9

5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - emerging approach for resource over provisioning, Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the various protocols in wireless networks.
- Describe the architecture of 3G network standards.
- Analyze the difference of LTE-A network design from 4G standard.
- Design the interconnecting network functionalities by layer level functions.
- Discuss the current generation (5G) network architecture.

TEXTBOOKS

1. Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2008.
2. Clint Smith, P.E, Dannel Collins, "3G Wireless Networks" Tata McGraw- Hill, Second Edition, 2011.

REFERENCES

1. Sassan Ahmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014.
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015.

E-RESOURCES

1. <https://nptel.ac.in/courses/124107164?> - Wearable & Smart Devices
2. https://onlinecourses.nptel.ac.in/noc23_ee95/preview? - Sensor Technologies: Physics, Fabrication, and Circuits

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	1	-	-	-	2	3	2	3
2	3	3	3	3	3	2	-	-	-	-	-	2	3
3	3	3	3	3	3	1	-	-	-	-	3	2	3
4	3	3	3	3	3	2	-	-	-	-	3	2	3
5	3	3	3	3	3	2	-	-	-	-	3	2	3
AVG	3	3	3	3	3	1.6	-	-	-	2	3	2	3

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


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23ECP614

4G/5G COMMUNICATION NETWORKS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the evolution of wireless networks from 2G to 4G.
- To develop the architecture of the 5G core network.
- To expose the concepts of network slicing and Multi-access Edge Computing (MEC).
- To inculcate mobility management and command-and-control mechanisms in 5G.
- To enhance the flow-based QoS framework in 5G.

UNIT I EVOLUTION OF WIRELESS NETWORKS

9

Networks evolution: 2G,3G,4G, evolution of radio access networks, need for 5G. 4G versus 5G, Next Generation core(NG-core), visualized Evolved Packet core(vEPC).

UNIT II 5G CONCEPTS AND CHALLENGES

9

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT III NETWORK ARCHITECTURE AND THE PROCESSES

9

5G architecture and core, network slicing, multi access edge computing(MEC)visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPsec and GRE.

UNIT IV DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES

9

Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.

UNIT V SECURITY IN 5G NETWORKS

9

Security features in 5G networks, network domain security, user domain security, flow based QoS framework,mitigating the threats in 5G.

TOTAL: 45 PERIODS

OUTCOMES

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

- Explain the evolution of wireless communication systems from 2G to 4G.
- Discuss different Radio Access Technologies (RATs) and the role of EPC in 5G.
- Analyze service continuity and its relation to EPC and edge computing.
- Describe the application of cognitive radio in 5G networks.
- Discuss security threats in 5G and mitigation techniques.

TEXT BOOKS

1. Stephen Rommer, "5G Core networks: Powering Digitalization", Academic Press, 2019.
2. Saro Velrajan, "An Introduction to 5G Wireless Networks: Technology, Concepts and Use cases", First Edition, 2020.





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REFERENCES

1. Jyrki. T.J.Penttinen, "5G Simplified: ABCs of Advanced Mobile Communications", Copyrighted Material.
2. Wan Lee Anthony, "5G system Design: An end to end Perspective", Springer Publications, 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/117104099?> - Advanced 3G and 4G Wireless Mobile Communications
2. https://onlinecourses.nptel.ac.in/noc25_ee172/preview? - 5G Wireless Standard Design

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	-	-	-	-	-	-	1	3
2	3	3	3	2	2	-	-	-	-	-	-	1	2
3	3	3	2	2	2	-	-	-	-	-	-	2	2
4	3	3	3	3	2	-	-	-	-	-	-	3	2
5	3	2	3	3	2	-	-	-	-	-	-	2	2
AVG	3	2.8	2.6	2.6	2	-	-	-	-	-	-	1.8	2.2

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23ECP615

SOFTWARE DEFINED NETWORKS

L T P C
3 0 0 3

OBJECTIVES

- To introduce the SDN data plane architecture and its data plane operations.
- To inculcate control plane functions using the ITU-T SDN model.
- To introduce SDN applications in traffic engineering, monitoring, and measurement
- To gain the knowledge on NFV reference architecture and infrastructure.
- To explore the concepts of network virtualization.

UNIT I SDN: BACKGROUND AND DATA PLANE

9

Evolving Network Requirements – The SDN Approach – SDN and NFV-Related Standards – SDN Data Plane – OpenFlow Logical Network Device – OpenFlow Protocol.

UNIT II SDN CONTROL PLANE

9

SDN Control Plane Architecture: Southbound Interface, Northbound Interface – Control Plane Functions – ITU-T Model – OpenDaylight – REST – Cooperation and Coordination among Controllers.

UNIT III UNIT TITLE

9

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking -- -Mobility and Wireless – Information-centric Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION

9

NFV Concepts – Benefits and Requirements – Reference Architecture – NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

UNIT V NETWORK VIRTUALIZATION

9

Virtual LANs – OpenFlow VLAN Support – Virtual Private Networks – Network Virtualization – OpenDaylight's Virtual Tenant Network – CoSoftware-Defined Infrastructure
Describe the motivation behind SDN and its data plane (K2)

TOTAL: 45 PERIODS

OUTCOMES

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

- Describe the SDN data plane, including Open Flow architecture and protocol.
- Design the SDN control plane, including southbound and northbound interfaces and controller coordination.
- Explain the role of the SDN application plane.
- Apply various operations of network function virtualization, Infrastructure.
- Analyze network virtualization techniques, including VLANs, VPNs, virtual tenant networks.





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TEXT BOOKS

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud", Pearson Education, First Edition, 2015.
2. Thomas D Nadeau, Ken Gray, "SDN: Software Defined Networks", O'Reilly Media, 2013.

REFERENCES

1. Paul Goransson, Chuck Black Timothy Culver, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Press, Edition, 2016.
2. Oswald Coker, Siamak Azodolmolky, "Software-Defined Networking with OpenFlow", O'Reilly Media, Second Edition, 2017.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc26_cs60/preview? - Advanced Computer Networks
2. <https://nptel.ac.in/courses/106105183?> - Computer Networks and Internet Protocol

Mapping of COs-POs & PSOs

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

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23ECP615

MASSIVE MIMO NETWORKS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts of Massive MIMO systems.
- To develop capacity upper bounds and distance from favorable propagation.
- To gain knowledge on uplink and downlink data transmission schemes.
- To impart knowledge on multi-cell Massive MIMO systems with emphasis on uplink pilot transmission.
- To expose practical Massive MIMO deployment scenarios through real-world case studies.

UNIT I MASSIVE MIMO NETWORKS

9

Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favorable Propagation, Local Scattering Spatial Correlation Model

UNIT II THE MASSIVE MIMO PROPAGATION CHANNEL

9

Favorable Propagation and Deterministic Channels-Capacity Upper Bound-Distance from Favorable Propagation-Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-Independent Rayleigh Fading versus UR-LoS - Finite-Dimensional Channels

UNIT III SINGLE-CELL SYSTEMS

9

Uplink Pilots and Channel Estimation - Orthogonal Pilots- De-Spreading of the Received Pilot Signal-MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion-Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of Linear Processing when $M \gg K$ - Net Spectral Efficiency - Limiting Factors: Number of Antennas and Mobility

UNIT IV MULTI-CELL SYSTEMS

9

Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission -Zero-Forcing - Maximum-Ratio, Discussion -Asymptotic Limits with Infinite Numbers of Base Station Antennas - The Effects of Pilot Contamination - Non-Synchronous Pilot Interference

UNIT V CASE STUDIES

9

Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile Access - Dense Urban

TOTAL:45 PERIODS





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OUTCOMES

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

- Explain the fundamental concepts of Massive MIMO system
- Discuss capacity limits under different fading and line-of-sight conditions.
- Analyze maximum-ratio and zero-forcing processing in single-cell Massive MIMO systems.
- Describe multi-cell Massive MIMO systems, focusing on pilot contamination, non-synchronous pilot interference,
- Analyze practical Massive MIMO deployment scenarios through case studies in rural broadband access.

TEXT BOOKS

1. Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016.
2. Emil Björnson, Jakob Hoydis and Luca Sanguinetti (2017), "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017.

REFERENCES

1. Long Zhao, Hui Zhao, Kan Zheng, "Wei Xiang Massive MIMO in 5G Networks: Selected Applications", Springer 2018.
2. Leibo Liu, Guiqiang Peng, Shaojun Wei, "Massive MIMO Detection Algorithm and VLSI Architecture", Springer 2019.

E-RESOURCES

1. <https://nptel.ac.in/courses/117105132?> - Fundamentals of MIMO Wireless Communication
2. <https://nptel.ac.in/courses/117104115?> - Principles of Modern CDMA/MIMO/OFDM Wireless Communications

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	2	2	-	-	-	-	2	2	1
2	3	3	3	3	3	3	-	-	-	-	1	2	1
3	3	2	2	2	2	2	-	-	-	-	1	2	1
4	3	3	3	3	3	3	-	-	-	-	1	2	1
5	3	3	2	2	2	2	-	-	-	-	2	2	1
AVG	3	3	2.4	2.4	2.4	2.4	-	-	-	-	1.4	2	1

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


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23ECP617

ADVANCED WIRELESS COMMUNICATION TECHNIQUES

L T P C
3 0 0 3

OBJECTIVES

- To introduce cooperative communication techniques in OFDM and MIMO.
- To impart knowledge on antenna architectures supporting cooperative communications.
- To discuss radio resource optimization and adaptive resource allocation strategies.
- To enhance knowledge on cooperative multi-cell processing techniques for energy-efficient cellular communication.
- To gain knowledge on energy-efficient relaying techniques for cooperative cellular systems.

UNIT I COOPERATIVE COMMUNICATIONS AND GREEN CONCEPTS

9

Network architectures and research issues in cooperative cellular wireless networks ; Cooperative communications in OFDM and MIMO cellular relay networks: issues and approaches; Fundamental trade-offs on the design of green radio networks, Green modulation and coding schemes.

UNIT II COOPERATIVE TECHNIQUES

9

Cooperative techniques for energy efficiency, Cooperative base station techniques for cellular wireless networks; Turbo base stations; Antenna architectures for cooperation; Cooperative communications in 3GPP LTE-Advanced, Partial information relaying and Coordinated multi-point transmission in LTE-Advanced.

UNIT III RELAY-BASED COOPERATIVE CELLULAR NETWORKS

9

Distributed space-time block codes ; Collaborative relaying in downlink cellular systems ; Radio resource optimization; Adaptive resource allocation ; Cross-layer scheduling design for cooperative wireless two-way relay networks ; Network coding in relay-based networks.

UNIT IV GREEN RADIO NETWORKS

9

Base Station Power-Management Techniques- Opportunistic spectrum and load management, Energy-saving techniques in cellular wireless base stations , Power-management for base stations in smart grid environment, Cooperative multi cell processing techniques for energy-efficient cellular wireless communications.

UNIT V ACCESS TECHNIQUES FOR GREEN RADIO NETWORKS

9

Cross-layer design of adaptive packet scheduling for green radio networks; Energy-efficient relaying for cooperative cellular wireless networks ; Energy performance in TDD-CDMA multihop cellular networks ; Resource allocation for green communication in relay-based cellular networks ; Green Radio Test-Beds and Standardization Activities.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Describe the principles of cooperative cellular wireless networks and analyze green radio concepts.
- Examine cooperative techniques for improving energy efficiency in cellular networks.
- Apply relay-based cooperative communication techniques, network coding in cellular relay networks.
- Analyze green radio network strategies such as base-station power management.
- Discuss access and resource allocation techniques for green radio networks.

TEXT BOOKS

1. Ekram Hossain, Dong In Kim, Vijay K. Bhargava , "Cooperative Cellular Wireless Networks", Cambridge University Press, 2011.
2. Ekram Hossain, Vijay K. Bhargava(Editor), Gerhard P. Fettweis (Editor), "Green Radio Communication Networks", Cambridge University Press, 2012.

REFERENCES

1. F. Richard Yu, Yu, Zhang and Victor C. M. Leung "Green Communications and Networking", CRC press, 2012.
2. Jinsong Wu, Sundeep Rangan and Honggang Zhang, "Green Communications: Theoretical Fundamentals, Algorithms and Applications", CRC Press, 2012.

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	3	-	-	-	-	2	1	1
2	3	3	3	3	3	3	-	-	-	-	2	1	1
3	3	3	3	2	2	2	-	-	-	-	2	1	1
4	3	3	3	3	3	3	-	-	-	-	2	1	1
5	3	3	3	3	3	3	-	-	-	-	2	1	1
AVG	3	3	3	2.8	2.8	2.8	-	-	-	-	2	1	1

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


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23ECP618

SATELLITE COMMUNICATION

L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals of satellite orbits, orbital mechanics, and launch procedures.
- To impart knowledge on spacecraft technology and communication subsystems.
- To expose the basics concepts of uplink and downlink.
- To enhance the modulation, multiplexing, multiple access, and coding techniques in satellite systems.
- To discuss the applications of satellites in GSM, GPS.

UNIT I SATELLITE ORBITS

9

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geostationary and non Geo-stationary orbits - Look Angle Determination- Limits of visibility- eclipse-Sub satellite point - Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT

9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command- Transponders-The Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN

9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING METHODS

9

Modulation and Multiplexing: Voice, Data, Video, Analog - digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression - encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS

9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL: 45 PERIODS





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OUTCOMES

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

- Explain the fundamentals of satellite orbits, orbital mechanics, and launch procedures.
- Examine spacecraft systems and the functioning of communication subsystems.
- Analyze the operation of uplink and downlink processes in satellite communication systems.
- Explain the modulation, multiplexing, multiple access, and coding methods in satellite communication systems.
- Analyze the various applications of satellite technologies in GSM, GPS.

TEXT BOOKS

1. Dennis Roddy, "Satellite Communication", , Mc Graw Hill International, Fourth Edition, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt," Satellite Communication", Wiley Publications, Second Edition, 2002.

REFERENCES

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.

E-RESOURCES

1. <https://nptel.ac.in/courses/117/105/117105131/> (Satellite Communication systems)
2. <https://nptel.ac.in/courses/105/107/105107194/> (Global Navigation Satellite Systems and Applications)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	-	-	-	-	-	-	-	-	1	3	2
2	3	3	-	-	-	-	-	-	-	-	1	3	2
3	3	3	3	3	-	-	-	-	-	-	3	3	3
4	3	3	3	3	3	-	-	-	-	-	3	3	3
5	3	3	3	3	3	1	-	-	-	-	3	3	3
AVG	3	3	3	3	3	1	-	-	-	-	2.2	3	2.6

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

Chairman - BoS





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OPEN ELECTIVE I

23CEO607

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

LT P C
3 0 0 3

OBJECTIVES

- To explore the Rio principles of environmental impact assessment.
- To enhance the screening and scoping in EIA.
- To develop the environmental monitoring plan and EIA report preparation.
- To inculcate the baseline monitoring of social economic environment.
- To instruct the EIA case studies pertaining to infrastructure projects.

UNIT I INTRODUCTION

9

Impacts of Development on Environment – Rio Principles of Sustainable Development- Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework.

UNIT II ENVIRONMENTAL ASSESSMENT

9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise, flora and fauna - Matrices – Networks Checklist Methods - Mathematical models for Impact prediction.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN

9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Public Hearing- Environmental Clearance.

UNIT IV SOCIO ECONOMIC ASSESSMENT

9

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT V CASE STUDIES

9

EIA case studies pertaining to Infrastructure Projects – Roads and Bridges – Mass Rapid Transport Systems- Airports - Dams and Irrigation projects - Power plants.

TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the impacts of development on environment.
- Analyze the scoping and screening of developmental projects for environmental and social assessments.
- Construct the environmental management plans and EIA reports.
- Apply the economic valuation of environmental impacts and cost benefit analysis.
- Identify the EIA case studies pertaining to Infrastructure Projects.





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TEXT BOOKS

1. Canter, R.L., "Environmental impact Assessment ", Second Edition, McGraw Hill Inc, New Delhi, 1995.
2. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank, 1997.
3. Peter Morris, Piki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, First Edition, 2009.

REFERENCES

1. Becker H. A., Frank Vanclay, "The International handbook of social impact assessment" Conceptual and Methodological Advances, Edward Elgar Publishing, 2003.
2. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 1998.

E-RESOURCES

1. <https://nptel.ac.in/courses/124107160> (Environmental Impact Assessment)
2. https://onlinecourses.nptel.ac.in/noc25_ch24/preview (Environmental Quality Monitoring & Analysis)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	2	–	2	3	–	–	–	–	-	-
2	3	3	2	2	–	2	3	–	–	–	–	-	-
3	3	3	3	2	2	2	3	–	–	–	2	-	-
4	3	3	2	2	–	2	3	–	–	–	3	-	-
5	3	3	3	2	2	3	3	–	–	–	2	-	-
AVG	3.0	3.0	2.4	2.0	2.0	2.2	3.0	–	–	–	2.3	-	-

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

Chairman - BoS





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23CSO610	INTRODUCTION TO DRONE TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To impart fundamental knowledge of drone technology, including its concepts, terminology, historical evolution, and emerging applications.
- To develop students' understanding of UAV architecture, drone components, fabrication techniques, and programming methodologies.
- To train students in drone flight operations, navigation systems, sensors, data acquisition, and UAV management tools.
- To enable students to explore commercial applications of drones in sectors such as agriculture, logistics, inspection, surveillance, and aerial imaging.
- To familiarize students with drone safety regulations, licensing requirements, and emerging technologies including autonomous and swarm-based UAV systems.

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept-Vocabulary Terminology-History of drone-Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses-Drone business through entrepreneurship-Opportunities/applications for entrepreneurship and Employability.

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program – Install program on computer-Running Programs-Multi rotor stabilization-Flight modes-Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity-Removable storage devices-Linked mobile devices and applications.

UNIT IV DRONE COMMERCIAL APPLICATIONS 9

Choosing a drone based on the application-Drones in the insurance sector-Drones in delivering mail, parcels and other cargo-Drones in agriculture-Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing.

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks-Guidelines to fly safely –Specific aviation regulation and standardization-Drone License-Miniaturization of drones-Increasing autonomy of drones-The use of drones in swarms.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Explain the fundamental concepts, terminology, classifications, history, and applications of drone technology.
- Design a multirotor drone by selecting appropriate hardware appropriate components and tools.
- Apply flight control principles, navigation methods, onboard sensors, and UAV management tools for drone flight operations.
- Analyze the drone technologies for commercial applications such as aerial imaging, agriculture, logistics, infrastructure inspection, and surveillance
- Analyze drone safety regulations, licensing requirements, and emerging technologies including autonomous drones and swarm intelligence for future UAV applications.

TEXTBOOKS

1. Daniel Tal and John Altschuld, "Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation", John Wiley & Sons, First Edition, 2021.
2. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones, Maker Media, Inc.", Sheroff Publishers and Distributors Pvt Ltd, First Edition, 2015.

REFERENCES

1. John Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, First Edition, 2016.
2. Zavrnik, "Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance", Springer, First Edition, 2018.

E-RESOURCES

1. <http://www.digimat.in/nptel/courses/video/101108661/L50.html> (Fundamentals of Drone Technologies)
2. <http://www.digimat.in/nptel/courses/video/101108661/L38.html> (Drone Technology Commercial Application)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	2	1	3	-	-	-	-	-	3	-	-
2	3	3	3	2	3	-	-	-	-	-	3	-	-
3	3	3	2	2	3	-	-	-	-	-	3	-	-
4	2	3	2	2	3	-	-	1	-	-	2	-	-
5	2	3	3	2	3	-	-	2	-	-	2	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-	-
Avg	2.6	2.8	2.4	1.8	3	-	-	1.5	-	-	2.6	-	-

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

Chairman - BoS





23ECO602 FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS L TP C
3 0 0 3

OBJECTIVES

- To introduce fundamental knowledge of semiconductors and devices and its applications.
- To discuss the operation and characteristics of Bipolar Junction Transistor.
- To expose the various types of oscillators and FET.
- To inculcate the operation of power semiconductor devices.
- To impart knowledge on optoelectronic devices and wave shaping circuits.

UNIT I SEMICONDUCTOR AND DIODES

9

Semiconductor - Definition, classification, intrinsic and extrinsic N type & p type – drift current & diffusion current diodes – PN junction diode – forward and reverse bias characteristics – specification – zener diode construction & working Principle -characteristics - zener break down - avalanche break down.

Rectifier – introduction-classification of rectifiers-half wave rectifier-full wave Rectifier (center tapped, bridge) - (no mathematical equations) – comparison – Applications - filters-C, LC and PI filters.

UNIT II BIPOLAR JUNCTION TRANSISTOR

9

Transistor – NPN and PNP transistor – operation-transistor as an amplifier- transistor as a switch – CB,CE,CC configurations – characteristics - comparison between three configurations in terms of input impedance, output impedance, current gain, voltage gain – negative feedback Concept, effect of negative feedback – types of negative feedback connections.

UNIT III TRANSISTOR OSCILLATORS AND FET

9

Transistor oscillators – Classifications – Condition for oscillations (Barkhausen criterion) – General form of Hartley Oscillator – Colpitts Oscillator – RC Phase shift oscillator.

Field Effect Transistor – construction – working principle of FET – difference Between FET and BJT – classification of FET – characteristics of FET – Applications.

UNIT IV SCR, DIAC, TRIAC

9

SCR – introduction – working – VI-characteristics -comparison between SCR and transistor – SCR as a switch, controlled rectifier. TRIAC working principle, Characteristics –DIAC –characteristics –DIAC as bi- directional switch. Applications of SCR, TRIAC and DIAC.

UNIT V OPTOELECTRONIC DEVICES AND WAVE SHAPING CIRCUITS

9

Classification of optoelectronic devices – symbols, Characteristics, working of LDR, LED, 7 segment LED and LCD– opto coupler - Photo transistor. Clipper, Clamper Circuits and waveforms only – Astable, Monostable Multivibrators and Schmitt trigger using transistors.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Understand the concept of semiconductor, diodes and its applications.
- Discuss the various biasing circuits using BJT.
- Explain the oscillator circuits and Field Effect Transistor.
- Analyze the operation of power semiconductor devices and its applications.
- Explain the operation of optoelectronic devices and wave shaping circuits.

TEXTBOOKS

1. Robert L. Boylestad, Louis Nashelsky "Electronic Devices and Circuits Theory", Prentice Hall Publications, Tenth Edition, 2009.
2. S.Salivahanan, N.Sureshkumar, , "Electronic Devices and Circuits", McGraw Hill, Fifth Edition, 2022.

REFERENCE

1. G.S.N. Raju, "Electronic Devices and Circuits", I.K. International Publications, New Delhi, First Edition, 2006.
2. A.P Godse, U.A Bakshi , "Electronic Devices and Circuits", Technical Publications, 2010.

E-RESOURCES

1. <https://nptel.ac.in/courses/108108122> - (Fundamentals of Semiconductor Devices).
2. https://onlinecourses.nptel.ac.in/noc21_ee86 - (Microelectronics: Devices To Circuits).

Mapping of COs - POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	3	3	3	2	-	-	-	-	3	-	-
2	3	3	3	3	2	3	-	-	-	-	2	-	-
3	3	3	3	3	3	2	-	-	-	-	3	-	-
4	3	3	3	3	3	2	-	-	-	-	2	-	-
5	3	3	3	3	3	3	-	-	-	-	2	-	-
AVG	3	3	3	3	2.8	2.4	-	-	-	-	2.4	-	-

1-Low, 2 - Medium, 3 - High, '-' – No correlation

Chairman - BoS





23EEO603

ELECTRIC VEHICLE TECHNOLOGY

LTP C

3 0 0 3

OBJECTIVES

- To impart knowledge on the basic concepts and working of electric vehicles.
- To familiarize with battery types, parameters, and battery pack design for electric vehicles.
- To instruct on DC and AC electrical machines used in electric vehicle applications.
- To develop understanding of electric vehicle drive train components and regenerative braking.
- To foster awareness of hybrid electric vehicle types, configurations, and component sizing.

UNIT I ELECTRIC VEHICLES

9

Introduction – Components - Vehicle mechanics - Roadway fundamentals - Vehicle kinetics
Dynamics of vehicle motion Propulsion System Design.

UNIT II BATTERY

9

Basics-Types-Parameters Capacity, Discharge rate, State of charge, state of discharge, Depth of discharge-Technicalcharacteristics-BatterypackdesignPropertiesofbatteries

UNIT III DC&AC ELECTRICAL MACHINES

9

Motor and engine rating-Requirements-DC machines-Three phase AC machines-Induction machines – Permanent magnet machines-BLDC Motor Switched reluctance machines

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN

9

Transmissionconfiguration-Components-Gears-Differential-Clutch-Brakes
braking – Motor sizing

UNIT V HYBRID ELECTRIC VEHICLES

9

Types-Series-Parallel and series-Parallel configuration -Design-Drivetrain Sizing of components.

TOTAL: 45 PERIODS



OUTCOMES

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

- Analyze the basic concepts and working of electric vehicles.
- Apply the battery types, parameters in battery pack design.
- Explain the DC and AC electrical machines used in electric vehicles.
- Identify the electric vehicle drive train components and regenerative braking.
- Examine the hybrid electric vehicle types, configurations, and component sizing.

TEXT BOOKS

1. C. Mi, M. A. Masrur and D. W. Gao, "Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley&Sons, Second Edition, 2017.
2. S.Onori, L. Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies", Springer, First Edition, 2015.

REFERENCES

1. Iqbal Hussain, "Electric & Hybrid Vehicles - Design Fundamentals", CRC press, Second Edition, 2011.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge, Second Edition, 2020.

E-RESOURCES

1. <https://nptel.ac.in/courses/108103009> - (Hybrids and Electric Vehicle)
2. <http://nptel.ac.in/courses/108103009/> - (Electric Vehicle)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS



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23EEO604

RENEWABLE ENERGY SYSTEMS

L T P C
3 0 0 3

OBJECTIVES

- To impart knowledge on renewable energy sources and their role in sustainable energy development.
- To familiarize with the working and applications of wind energy systems.
- To develop understanding of solar photovoltaic and solar thermal energy systems.
- To instruct on biomass, geothermal, and hydroelectric energy systems.
- To get knowledge on other renewable energy sources and energy storage systems.

UNIT I RENEWABLE ENERGY SOURCES

9

Environmental consequences of fossil fuel use - Importance of Renewable Sources (RE) of energy - Sustainable design and development - Types of RE sources - Limitations of RE sources - Present Indian and international energy scenario of conventional and RE sources.

UNIT II WIND ENERGY

9

Power in the wind - Types of wind power plants (wpps) - Components of wpps - Working of wpps - Siting of wpps - Grid integration issues of wpps.

UNIT III SOLAR PV AND THERMAL SYSTEMS

9

Solar radiation - Radiation measurement - Solar thermal power plant - Central receiver power plants - Solar ponds - Thermal energy storage system with pcm - Solar photovoltaic systems - Basic principle of spv conversion - Types of pv systems -Maximum power point tracking - Best free solar pv system simulation.

UNIT IV BIOMASS ENERGY

9

Introduction - Bio mass resources - Energy from bio mass - Conversion processes - Biomass cogeneration - Environmental benefits - Geothermal energy - Basics - Direct use - Geothermal electricity - Mini/micro hydro power - Classification of hydropower schemes - Classification of water turbine - Turbine theory - Essential components of hydroelectric system.

UNIT V OTHER ENERGY SOURCES

9

Tidal energy - Energy from the tides - Barrage and non-barrage tidal power systems - Wave energy - Energy from waves - Wave power devices - Ocean thermal energy conversion (OTEC) - Hydrogen production and storage - Fuel cell - Principle of working - Various types - Construction and applications - Energy storage system - Hybrid energy systems.

TOTAL : 45 PERIODS





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OUTCOMES

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

- Explain the importance and types of renewable energy sources.
- Analyze the working and components of wind energy systems.
- Discuss how solar photovoltaic and solar thermal systems work.
- Determine biomass, geothermal, and hydroelectric energy systems.
- Examine tidal, wave, ocean thermal, fuel cell, and hybrid energy systems.

TEXT BOOKS

1. Scott Grinnell, "Renewable Energy & Sustainable Design", Cengage Learning, USA, Second Edition, 2016.
2. Richard A. Dunlap, "Sustainable Energy", Cengage Learning India Private Limited, Second Edition, 2015.

REFERENCES

1. ShobhNath Singh, "Non-conventional Energy resources", Pearson Education India, Second Edition, 2015.
2. Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis, "Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, First Edition, 2016.

E-RESOURCES

1. <https://nptel.ac.in/courses/108/108/108108078/> - (Renewable Energy Systems)
2. <https://nptel.ac.in/courses/108/105/108105058/> - (Non-Conventional Energy resources)

Mapping of COs-POs & PSOs

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

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

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23MEO601

INTRODUCTION TO INDUSTRIAL ENGINEERING

L T P C

3 0 0 3

OBJECTIVES

- To enable students to grasp the fundamental concepts, scope, and role of Industrial Engineering in manufacturing and service systems.
- To expose students to plant location, facility layout, and production planning concepts relevant to real-world industries.
- To develop analytical ability to apply work study, method study, and ergonomics principles in industrial environments.
- To equip students with foundational knowledge of statistical quality control and its application in process improvement.
- To prepare the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.

UNIT I INTRODUCTION

9

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT II PLANT LOCATION AND LAYOUT

9

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT III WORK SYSTEM DESIGN & ERGONOMICS

9

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study – Work sampling- Ergonomics and its areas of application in the work system - Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing.

UNIT IV STATISTICAL QUALITY CONTROL

9

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Acceptance Sampling- O.C curve –Single sampling plan- Double sampling plan.

UNIT V PRODUCTION PLANNING AND CONTROL

9

Forecasting –Techniques – Types of production – Process planning – Economic Batch Quantity– Loading – Scheduling and control of production.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Apply the concepts of productivity and productivity measurement approaches.
- Examine appropriate location models for various facility types and design various facility layouts.
- Analyze and conduct method study and time study to improve the efficiency of the system.
- Examine the quality of processes using control charts in manufacturing/service industries.
- Apply knowledge and skills for planning strategies and preparing a Material Requirement Plan (MRP).

TEXTBOOKS

1. Martand Telsang, 2016, "Industrial Engineering and Production Management", S. Chand and Company.
2. Khanna O. P., and Sarup A., "Industrial Engineering and Management", Dhanpat Rai Publications, New Delhi, 2020,
3. George Kanwaty, "Introduction to Work Study", ILO, Geneva, 2016,

REFERENCES

1. Ravi Shankar, 2019, "Industrial Engineering and Management", Galgotia Publications & Private Limited.
2. Norberd Lloyd Enrick., "Industrial Engineering Manual for Textile Industry", Wiley Eastern (P) Ltd., New Delhi, 2018,
3. Enrick N. L., "Time study manual for Textile industry", Wiley Eastern (P) Ltd., 2019,

E-RESOURCES

1. <https://nptel.ac.in/courses/112107292> (Principles of Industrial Engineering)
2. https://onlinecourses.nptel.ac.in/noc25_me181/preview- (Industrial Engineering and Operations Research)

Mapping of Cos-Pos & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	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





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23MEO605

CNC MACHINING TECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce students to the fundamentals of computer graphics, CAD systems, geometric transformations, and viewing techniques used in computer-aided design.
- To provide knowledge on geometric modeling techniques, assembly modeling, graphics standards, and product data exchange standards used in CAD applications.
- To explain the construction, components, control systems, and operational features of CNC machines and advanced machining centres.
- To familiarize students with manual and computer-aided CNC part programming techniques using APT, CAM packages, and canned cycles.
- To develop an understanding of Computer-Aided Manufacturing (CAM), Computer Integrated Manufacturing (CIM), manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) manufacturing concepts.

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS

9

Product cycle - Design process - sequential and concurrent engineering - Computer-aided design - CAD system architecture - Computer graphics - coordinate systems - 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping - viewing transformation.

UNIT II GEOMETRIC MODELING

9

Geometric Modeling -types - Wireframe, surface and solid modeling - Boundary Representation, constructive solid geometry - Graphics standards - assembly modeling - use of software packages - Data exchange standards - IGES, STEP, CALS, etc. - Communication standards.

UNIT III CNC MACHINES

9

NC, CNC & DNC - types of CNC - constructional features - drives and control systems - feedback devices - Interchangeable tooling system - preset & qualified tools - ISO specification - Machining center - Turning center - CNC EDM - CNC wire cut EDM.

UNIT IV CNC PROGRAMMING

9

Manual part programming - steps involved - sample program in lathe & milling. - Computer-aided part programming -APT - CAM package - canned cycles - Programming.

UNIT V FUNDAMENTALS OF CAM

9

Brief introduction to CAM - Manufacturing Planning, Manufacturing control - Concurrent Engineering - CIM concepts - Computerized elements of CIM system - Types of production Basic Elements of an Automated system - Levels of Automation - Lean Production and Just-In-Time Production.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the principles of computer graphics, CAD system architecture, coordinate systems, geometric transformations, and viewing techniques used in computer-aided design.
- Examine geometric modeling techniques, assembly modeling approaches, graphics standards, and data exchange standards for engineering design applications.
- Compare the constructional features, control systems, tooling arrangements, and operational characteristics of CNC machines and advanced machining centres.
- Classify CNC programming techniques, including manual part programming, computer-aided part programming, APT, CAM packages, and canned cycles for manufacturing applications.
- Differentiate the concepts of CAM, CIM, manufacturing planning and control, automation, lean production, and Just-in-Time (JIT) production in modern manufacturing systems.

TEXTBOOKS

- Mikell P. Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing, Pearson Education", Fifth Edition, 2023.
- Ibrahim Zeid, "Mastering CAD/CAM", McGraw-Hill Education, Third Edition, 2021.
- P. N. Rao, "CAD/CAM: Principles and Applications", McGraw-Hill Education (India), Fourth Edition, 2022.

REFERENCES

- M. P. Groover and Emory W. Zimmers Jr., "CAD/CAM: Computer-Aided Design and Manufacturing", Pearson Education, Second Edition (Reprint), 2020
- M. P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", John Wiley & Sons, Eighth Edition, 2025
- Ibrahim Zeid and R. Sivasubramanian, "CAD/CAM: Theory and Practice", McGraw Hill Education, Second Edition, 2020.

E-RESOURCES

- <https://nptel.ac.in/courses/112102103> (Overview of CNC machines)
- <http://www.digmat.in/nptel/courses/video/112104289/L20.html> (CNC Part Programming)

Mapping of COs-POs &PSOs

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

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


Chairman - BoS





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23MDO611

HOSPITAL MANAGEMENT

L T P C

3 0 0 3

OBJECTIVES

- To familiarize students with the fundamentals of hospital administration and management.
- To impart knowledge on human resource management practices in healthcare organizations.
- To explore marketing research processes and consumer behavior in healthcare services.
- To introduce hospital information systems and supportive healthcare services.
- To inculcate awareness of quality assurance, accreditation standards, and patient safety practices.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION

9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning- Equipment Planning – Functional Planning - Current Issues in Hospital Management – Telemedicine - Bio-Medical Waste Management.

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL

9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD – Human Resource Inventory – Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines –Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer, Communication – nature, scope, barriers, styles and modes of communication.

UNIT III MARKETING RESEARCH PROCESS

9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations – Consumer Markets & Consumer Buyer Behavior - Model of consumer behavior - The buyer decision process - Model of business buyer behavior – Major types of buying situations - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

9

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department– Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL

9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care – Medical Audit – Hazard and Safety in a hospital Setup.





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TOTAL: 45 PERIODS

OUTCOMES

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

- Examine the principles and functions of hospital administration in healthcare organizations.
- Analyze human resource management practices and their role in hospital operations.
- Apply marketing research techniques for healthcare service management.
- Utilize hospital information systems and supportive services for decision-making.
- Develop quality assurance and patient safety strategies in healthcare settings.

TEXT BOOKS

1. Gupta Joydeep Das, "Hospital Administration and Management: A Comprehensive Guide", Third Edition, 2023.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi, Fifth Edition, Reprint 2018.

REFERENCES

1. Bruce J. Fried and Myron D. Fottler, "Human Resources in Healthcare Managing for Success", Fourth Edition, 2020.
2. James R. Langabeer, "Handbook on Health Care Operations Management", Jones & Bartlett Publishers, 2020.

E-RESOURCES

1. <https://www.youtube.com/watch?v=2J-F4Fi2VRQ> – (Introduction to Human Resource Management in Healthcare Settings)
2. <https://www.youtube.com/watch?v=dXHJemWm1xI&pp=ygUVI2hvc3BpdGFsX2luZm9ybWF0aW9u> – (Hospital Information Management Software (HIMS))

Mapping of COs, POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	1	3	1	-	-	2	1	-	-	1	1	-	-
2	1	2	2	1	-	1	2	1	1	2	1	-	-
3	1	2	3	1	1	1	1	-	1	2	1	-	-
4	1	2	2	2	3	1	1	-	1	1	2	-	-
5	1	3	2	2	2	3	2	1	1	2	2	-	-
AVG.	1	2.4	2	1.5	2	1.6	1.4	1.0	1.0	1.6	1.4	-	-

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

Chairman - BoS





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23RAO609

FUNDAMENTALS OF ROBOTICS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basics of robots, including anatomy, types, specifications, and applications.
- To impart knowledge on robot kinematics, including forward/inverse kinematics and transformation matrices for manipulators.
- To familiarize with robot drive systems and end effectors, including types, features, applications, and design considerations.
- To discuss sensors in robotics, including force, tactile, proximity, and their applications and safety aspects.
- To enhance understanding of robot programming and its applications in industrial and specialized fields.

UNIT I BASICS OF ROBOT

9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT KINEMATICS

9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS

9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS

9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism

UNIT V PROGRAMMING AND APPLICATIONS OF ROBOT

9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effectors Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Identify robot types, anatomy, specifications, and applications.
- Illustrate forward and inverse kinematics of manipulators using transformation matrices.
- Analyze and select appropriate drive systems and end effectors for robotic applications.
- Apply sensor technologies and safety systems to robotic cells for reliable detection, hazard prevention, and compliant operation.
- Apply robot programming techniques and analyze their applications in industrial and specialized fields.

TEXTBOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, Second Edition, 2015.
2. Mikell.P.Groover, "Industrial Robotics–Technology, Programming and applications", McGraw Hill, Second Edition, 2017.

REFERENCES

1. Fu K.S. Gonzalez R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co., Second Edition, 2007.
2. John. J.Craig, "Introduction to Robotics: Mechanics and Control", Fourth Edition, 2022.

E-RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me37/preview- (Fundamentals of Robotics)
2. <https://archive.nptel.ac.in/courses/112/108/112108298> (Basics of Robotics)

Mapping of COs-POs& PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	3	3	-	1	-	2	-	1	-	-
2	3	2	-	3	3	-	-	-	2	-	2	-	-
3	3	2	-	3	3	-	-	2	2	2	2	-	-
4	3	2	-	3	3	2	-	2	2	2	2	-	-
5	3	2	-	2	3	2	-	2	2	3	3	-	-
AVG	3.0	2	-	2.8	3.0	2.0	1.0	2.0	2.0	2.3	2.0	-	-

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


Chairman - BoS





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23CSO612

CYBER FORENSICS AND ETHICAL HACKING

L T P C

3 0 0 3

OBJECTIVES

- To impart knowledge about the cybercrime and forensics.
- To acquire knowledge about forensic tools used for evidence acquisition and analysis.
- To familiarize with skills to collect, analyse, and present digital evidence following accepted forensic procedures and legal requirements.
- To impart the fundamental concepts, principles, and scope of ethical hacking in cyber security.
- To acquire the ethical hacking principles and security best practices to identify, analyze, and mitigate vulnerabilities in web applications

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS

9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process -Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II FORENSICS TOOLS

9

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools- Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices -Chain of Custody- Forensic Tools

UNIT III VALIDATING FORENSICS DATA

9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India.

UNIT IV ETHICAL HACKING

9

Introduction to Ethical Hacking – Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking.

UNIT V ETHICAL HACKING IN WEB

9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web

Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Understand the basics of cybercrime and computer forensics
- Apply the forensic tools for acquiring, preserving, and analyzing digital evidence
- Analyze and validate digital evidence by applying standard forensic procedure
- Apply ethical hacking methodologies to perform reconnaissance, scanning, enumeration, and vulnerability
- Analyze the security vulnerabilities in web applications, wireless networks, and mobile platform.

TEXT BOOKS

1. Bill Nelson, Amelia Phillips, Christopher Stuart, "Guide to Computer Forensics and Investigations", Cengage Learning, India, Sixth Edition, 2019.
2. CEH official "Certified Ethical Hacking Review Guide", Wiley India Edition, Version 11, 2021.
3. Deje, S. Murugan, "Cyber Forensics", Oxford University Press, India, 2018

REFERENCES

1. John R. Vacca, "Computer Forensics", Cengage Learning, 2005
2. Marjie T. Britz, "Computer Forensics and Cyber Crime: An Introduction", Third Edition, Prentice Hall, 2013.
3. Ankit Fadia "Ethical Hacking", Second Edition, Macmillan India Ltd, 2006
4. Kenneth C. Brancik "Insider Computer Fraud" Auerbach Publications, Taylor & Francis Group- 2008.

E-RESOURCES

1. https://onlinecourses.swayam2.ac.in/e-learning/preview/cec21_ge10
2. <https://nptel.ac.in/courses/106105217>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	1	1	-	-	-	1	-	-
CO2	3	2	1	2	3	1	2	1	1	-	2	-	-
CO3	3	3	1	3	3	2	3	1	2	-	2	-	-
CO4	3	3	2	2	3	2	2	1	1	-	2	-	-
CO5	3	3	3	2	3	2	3	1	2	1	3	-	-
AVG	3	2.6	1.75	2.25	2.6	1.6	2.2	1	1.5	1	2	-	-

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


Chairman - BoS





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23PMO608

PHARMACEUTICAL NANOTECHNOLOGY

L T P C

3 0 0 3

OBJECTIVES

- To introduce the evolution, principles, and applications of nanotechnology in drug delivery.
- To familiarize students with the principles of biopharmaceutics and pharmacokinetics.
- To provide knowledge of the principles, preparation, characterization, evaluation, and pharmaceutical applications of closed bilayered drug delivery systems.
- To develop a comprehensive understanding of programmed drug delivery systems, drug targeting strategies,
- To enhance understanding of the interactions of nanomaterials with biological systems, nanotoxicity.

UNIT I FUNDAMENTALS OF NANOTECHNOLOGY IN DRUG DELIVERY

9

Nanotechnology in Drug Delivery- Past, Present and Future- Conventional delivery of pharmaceuticals and its limitations, Significance of nano-size in Pharmacy, biotechnology and medicine, Physicochemical Principles of nano-sized Drug Delivery Systems, Biopharmaceutical, Physiological, and Clinical Considerations for Nanotechnology in Drug Delivery.

UNIT II PHARMACOKINETICS AND BIO DISTRIBUTION

9

Introduction- Definitions, concepts of Absorption, Distribution, Metabolism and excretion, concentration time profile, Bioavailability, bio pharmaceutics and pharmacokinetics in drug research. Biotransformation of drugs- Drug metabolizing enzymes, chemical pathways of Drug transformation, Phase-I and Phase-II reactions, Factors affecting drug transformation Prodrugs- Application of produg design.

UNIT III NANO CARRIERS FOR DRUG DELIVERY

9

Closed bilayered system- Introduction, structural aspects, preparation, characterization, evaluation and applications of liposomes, niosomes, erythrosomes. Polymeric Nanoparticles- Introduction, preparation, characterization, evaluation and pharmaceutical applications.

UNIT IV CONTROLLED AND TARGETED DRUG DELIVERY

9

Programmed Drug Delivery Systems- principles of sustained, controlled, pulsatile and triggered release of drug from nanoparticles. Concept of targeting- Targeting Approaches, Transport Across Biological Barriers, mechanisms of drug targeting, Ideal carrier system and approach Disease-Related Approaches by Nanotherapeutics- nanoparticles for Cancer, Skin Diseases, Bacterial, Diseases, Parasites Diseases and Inflammatory Disease.





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UNIT V NANO TOXICOLOGY AND REGULATORY ISSUES

9

Human health and safety- Interaction of nanomaterials with biological systems, Toxicology of nanoparticles- in-vitro and in-vivo, Complications with Nanotoxicity studies, environmental impact of nano-materials, Regulatory Toxicology.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply the physicochemical principles governing nano-sized drug delivery systems.
- Explain the role of biopharmaceutics and pharmacokinetics in drug discovery, development, and therapeutic optimization.
- Analyze the physicochemical properties and performance of liposomes, niosomes, erythroosomes, and polymeric nanoparticles for pharmaceutical applications.
- Explain the principles of programmed drug delivery systems, including sustained, controlled, pulsatile, and triggered drug release from nanoparticles.
- Apply appropriate approaches to assess the toxicological effects and safety of nanomaterials using in-vitro and in-vivo studies.

TEXT BOOKS

- Padma Devarajan, Sanyog Jain, "Targeted Drug Delivery : Concepts and Design", Springer publisher, First Edition , 2015.
- M. A. Mateescu P. Ispas-Szabo E. Assaad, "Controlled Drug Delivery", Woodhead Publishing , Second Edition, 2014

REFERENCES

- Michael E. Aulton , "Pharmaceutics", Churchill Livingstone Publisher , Second Edition, 2013.
- Philippe Houdy, Marcel Lahmani, "Nanoethics and Nanotoxicology", Springer-Verlag Publisher, Second edition, 2011.

E-RESOURCES

1. <https://onlinelibrary.wiley.com/doi/book/10.1002/9783527800681>
2. <https://www.scribd.com/document/742651789/Nano-Technology-1>

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	3	2	3	2	2	-	-	-	-	2	-	-
2	2	2	2	3	2	1	2	-	-	-	2	-	-
3	2	2	2	2	2	2	3	-	-	-	2	-	-
4	2	3	3	3	3	2	1	-	-	1	2	-	-
5	3	3	3	3	3	2	2	1	-	-	3	-	-
AVG.	2.4	2.6	2.4	2.8	2.4	1.8	2	1	-	1	2.2	-	-

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

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TIRUCHENGODE - 637 205 NAMAKKAL (Dt) TAMILNADU



23MAO606

GRAPH THEORY

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts of graph theory.
- To explain the properties of trees, spanning trees, and fundamental circuits.
- To explain the concepts of connectivity and planarity.
- To provide knowledge of graph coloring, covering and partitioning.
- To introduce the concepts of directed graphs and Euler digraphs.

UNIT I INTRODUCTION, PATHS AND CIRCUITS

9

Graphs introduction – Finite and Infinite graphs – Incidence and degree – Isolated vertex, Pendant vertex and Null graph – Isomorphism – Sub graphs – Walks, Paths and Circuits – Connected graphs, disconnected graphs and components – Euler graphs – Hamiltonian paths and circuits.

UNIT II TREES AND FUNDAMENTAL CIRCUITS

9

Trees – Properties of trees – Pendant vertices in a tree – Distance and centers in tree – Rooted and binary trees – Spanning trees – Fundamental circuits – Spanning trees in a weighted graph.

UNIT III CONNECTIVITY AND PLANARITY

9

Connectivity and separability – Network flows – 1-isomorphism – 2-isomorphism – Combinational and geometric graphs – Planer graphs – Kuratowski's two graphs – Different representation of a planer graph.

UNIT IV COLORING, COVERING AND PARTITIONING

9

Chromatic number – Chromatic partitioning – Chromatic polynomial – Matching – Covering – Four color problem

UNIT V DIRECTED GRAPH

9

Directed graphs – Types of directed graphs – Digraphs and binary relations – Directed paths and connectedness – Euler digraphs.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Understand the fundamental concepts of graphs, paths, circuits, Euler and Hamiltonian graphs.
- Apply tree properties and fundamental circuits to solve engineering problems.
- Analyze graph connectivity, network flows and planar graphs for modeling real-world systems.
- Apply graph coloring, matching, covering, and partitioning techniques to optimization and scheduling problems.
- Analyze directed graph and Euler digraphs in engineering applications.

TEXT BOOKS

1. Narsingh Deo., " Graph theory with applications to engineering and computer Science ", Prentice-Hall of India Pvt.Ltd, Fifth Edition, 2016.
2. L.R.Foulds , "Graph Theory Applications", Springer LTD, Seventh Edition, 2016.

REFERENCES

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill Education (India) Private Ltd., Seventh Edition, 2011.
2. Ralph P Grimaldi and B.V Ramana., "Discrete and Combinatorial Mathematics", Pearson Education limited, Fifth Edition, 2014.

E-RESOURCES

1. <https://nptel.ac.in/courses/111106102> (Graph theory)
2. <https://nptel.ac.in/courses/128106001>(Graph theory)

Mapping of COs-POs & PSOs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	1	-	-
2	3	3	2	-	-	-	-	-	-	-	1	-	-
3	3	3	2	1	-	-	-	-	-	-	1	-	-
4	3	3	3	1	-	-	-	-	-	-	2	-	-
5	3	3	2	1	-	-	-	-	-	-	2	-	-
AVG	3	2.8	2.3	1	-	-	-	-	-	-	1.4	-	-

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

[Signature]
Chairman - BoS





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23NCCL01

GENERAL ELECTIVE

NCC AIRFORCE LEVEL 1

(Common to All UG Programme NCC Students)

L T P C

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OBJECTIVES

- To familiarize students with the organizational structure of the National Cadet Corps (NCC), the duties and responsibilities of cadets, the incentives offered, and the significance of various NCC camps.
- To impart knowledge on personality development by enhancing communication skills, self-awareness, creative thinking, critical thinking, and leadership qualities.
- To introduce students to the qualities of effective leadership through the study of eminent leaders, their contributions, and the values required for responsible citizenship.
- To inculcate a sense of social responsibility by encouraging active participation in community service activities and promoting awareness of the role of youth in nation-building.
- To provide an understanding of the importance of health, hygiene, yoga, environmental cleanliness, and obstacle training while motivating students to contribute towards the vision of a Clean India.
- To provide practical training in foot drill, rifle drill, ceremonial drill, and social service activities for developing discipline, teamwork, leadership, and a sense of community responsibility.

UNIT I-NCC GENERAL

7

Aims, objectives and Organization of NCC - incentives - duties of NCC Cadets - NCC camps - types - conduct.

UNIT II PERSONALITY DEVELOPMENT

7

Personality Development – Factors - Self Awareness - Communication skills –Empathy - Critical and Creative thinking - Decision making.

UNIT III LEADERSHIP

7

Leadership Capsule - Traits - Case studies - Leaders like APJ Abdul Kalam, RatanTata, shivaji, Tipu Sultan, Rabindranath Tagore, N Narayana murthy

UNIT IV SOCIAL SERVICE

7

Social Service Capsule – Basics - Rural development programmes – NGOs -Contribution of Youth - Swatch Bharath Abhiyan, Social evils - Drug Abuse - Digital Awareness - Waste Management - Women Health and Sanitation - Tree Plantation -Traffic Awareness - Pollution.

UNIT V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training – Adventure.





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PRACTICAL COMPONENT

10

S.No.	Name of the Experiment	CO Mapping	RBT
1	Foot Drill	CO1	Apply
2	Rifle Drill	CO1	Apply
3	Ceremonial Drill	CO2	Understand
4	Social Service and Community Development	CO4	Understand

TOTAL: 35+10= 45 PERIODS

OUTCOMES

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

- Explain the organizational structure of the NCC, the roles and responsibilities of cadets, and the significance of various NCC camps.
- Apply communication, self-awareness, and creative and critical thinking skills to demonstrate personality development and confidence.
- Analyze the leadership qualities and contributions of eminent leaders to develop effective leadership skills and responsible citizenship.
- Demonstrate social responsibility by participating in community service activities and promoting awareness of national development initiatives.
- Apply the principles of health, hygiene, yoga, environmental cleanliness, and obstacle training to maintain personal well-being and develop physical fitness.
- Demonstrate proficiency in foot drill, rifle drill, ceremonial drill, and social service activities by applying discipline, teamwork, leadership, and community service skills in practical situations.

TEXT BOOKS

1. Cadet Hand Book(Common Subjects),published by DG NCC.
2. Cadet Hand Book(Specialized Subjects),published by DG NCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG NCC.
2. Youth in Action, published by DGNCC.
3. The Cadet, Annual Journal of the NCC.
4. Précis Issued by respective Service Head quarters on specialized subject available to PI Staff as reference material.

E-RESOURCES

1. <https://www.indiancc.nic.in>
2. <https://www.indiancc.mygov.in>





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3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

Mapping of COs-POs & PSOs

CO – PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	–	–	–	3	3	2	2	–	2	–	–
CO2	2	3	2	–	–	3	2	3	3	3	2	–	–
CO3	2	3	2	2	–	3	3	2	2	2	2	–	–
CO4	3	2	2	2	–	3	3	2	3	2	2	–	–
CO5	3	2	2	2	2	3	3	2	–	–	2	–	–
CO6	2	2	3	–	–	3	3	3	3	2	2		
AVG.	2.5	2.3	2.2	2.0	2.0	3.0	2.8	2.3	2.6	2.25	2.0	–	–

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

U. Danda
Chairman - BoS





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23NCCL03

NCC ARMY WING LEVEL 3
(Common to All UG Programme NCC Students)

L T P C
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COURSE PREREQUISITES: 75% Attendance in First Year of NCC Course

OBJECTIVES

- To learn the basic structure of NCC and its organization, Incentives, duties of Cadets; imbibe the knowledge of various types of Camp.
- To motivate the cadets as confidence leaders by refining their personality and self-awareness, with the help of Communication skills and aware of creative, critical thinking abilities.
- To create an awareness on Military History and great heroes of India and to know about the important military operations
- To inspire the cadets to take part in the Social Service Activities and also to learn about the infantry battalion
- To acquire knowledge about the basics of health and hygiene, yoga, environment cleanliness and motivate young Indians towards the path of clean India and acquaint about obstacle training.
- To develop discipline, confidence, alertness, and coordination through the practice of basic foot drill movements and commands.

Unit I NCC GENERAL

7

Aims, objectives and Organization of NCC-incentives-duties of NCC Cadets-NCC camps- types - conduct.

Unit II PERSONALITY DEVELOPMENT

7

Personality Development -Factors-Self Awareness-Communication skills-Empathy-Critical and Creative thinking-Decision making.

Unit III MILITARY HISTORY

7

Military History-Biographies, Heroes Study of Battles of Indo-Pak War 1965,1971-OperationMeghdootandKargil.

Unit IV SOCIAL SERVICE& INFANTRYBATALLION

7

Social Service Capsule-Basics-Rural development programmes-NGOs-Contribution of Youth - Swatch Bharath Abhiyan, Social evils-Drug Abuse-Digital Awareness-Waste Management-Women Health and Sanitation- Organisation of Infantry, characteristics

Unit V HEALTH AND HYGIENE

7

Hygiene and sanitation – First Aid – Introduction to Yoga – Adventure – Environmental awareness and conservation – Obstacle Training -Adventure

TOTAL: 35 PERIODS





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OUTCOMES

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

- Understand the basic organization of NCC and roles, responsibilities of cadets for the smooth functioning of all camps
- Develop the cadets personality and to think divergently to break functional fixedness
- Identify the Leadership traits of military heroes and learn about their organization
- Understand the concept and important of Social service and evolution of infantry battalion
- Practice healthy practices to improve the personal sanitation and hygiene and get into the adventurous activities
- Execute drill procedures effectively while maintaining military etiquette, discipline, and coordination during parades.

TEXT BOOKS

1. Cadet Hand Book (Common Subjects), published by DGNCC.
2. Cadet Hand Book (Specialized Subjects), published by DGNCC.
3. ANO Handbook

REFERENCE BOOKS

1. Grooming tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
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4. Précis Issued by respective Service Headquarters on specialized subject available to PI Staff as reference material.

E - RESOURCES

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2. <https://www.indiancc.mygov.in>
3. https://www.play.google.com/MY_IAF
4. https://www.play.google.com/DGNCC_Training

LIST OF DRILLS

(Common to All UG Programme NCC Students)

1. Foot Drill
2. Rifle Drill
3. Ceremonial Drill
4. Social Service and Community Development

TOTAL = 10 PERIODS





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Chairman - Bos

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

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
1	2	2	-	-	-	2	-	3	2	2	1	-	-
2	-	2	-	-	-	2	-	2	3	3	2	-	-
3	2	2	-	-	-	3	-	3	3	2	3	-	-
4	-	2	2	-	-	3	3	2	2	2	2	-	-
5	2	2	-	-	-	3	3	2	2	1	2	-	-
6	2	2	3	-	-	2	-	2	3	2	2	-	-
AVG	2	2	2.5	-	-	2.5	3	2.5	2.5	2	2	-	-

Mapping of COs-POs & PSOs

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MANDATORY COURSE I



23MDC501

INTRODUCTION TO WOMEN AND GENDER STUDIES

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OBJECTIVES

- To introduce foundational concepts of sex, gender, masculinity, femininity, and socialization.
- To examine structural systems including patriarchy, essentialism, binaryism, power, and hierarchy.
- To study major theoretical frameworks of feminism
- To examine the history and evolution of global, national, and local women's movements.
- To analyze how gender is constructed and represented across language, popular visual media, and social media.

UNIT I CONCEPTS

Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY

Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS

Global, National and Local Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE

Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION

Advertising and popular visual media. Gender and Representation in Alternative Media. Gender and social media.

TOTAL: 30 PERIODS





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OUTCOMES

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

- Identify and articulate concepts of socialization, binaryism, essentialism, and hegemony in social structures.
- Differentiate among various feminist theories and explain their core ideological foundations.
- Illustrate the milestones of women's rights movements in Europe, America, and India.
- Deconstruct linguistic forms and literary narratives to expose implicit gender biases.
- Assess media representations of gender roles in advertising and alternative media critically.

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23MDC502

ELEMENTS OF LITERATURE

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OBJECTIVES:

- To explain students aware of the finer sensibilities of human existence through art.
- To develop students' appreciation of different literature forms as modes of human expression.
- To enhance reading, critical thinking, discussion, and writing skills through literary studies.
- To familiarize students with the essential elements, modes, and patterns of fiction and narrative perspective.
- To explore the representational, theatrical, and rhetorical elements of drama and poetry.

UNIT I RELEVANCE OF LITERATURE

Enhances Reading, thinking, discussing and writing skills. Develops finer sensibility for better human relationship. Increases understanding of the problem of humanity without bias. Providing space to reconcile and get a cathartic effect.

UNIT II ELEMENTS OF FICTION

Fiction, fact and literary truth, Fictional modes and patterns. Plot character and perspective.

UNIT III ELEMENTS OF POETRY

Emotions and imaginations. Figurative language. (Simile, metaphor, conceit, symbol, pun and irony). Personification and animation. Rhetoric and trend

UNIT IV ELEMENTS OF DRAMA

Drama as representational art, Content mode and elements, Theatrical performance, Drama as narration, mediation and persuasion, Features of tragedy, comedy and satire.

READINGS:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Univ Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L. Styan, Literary Licensing, 2011.

TOTAL: 30 PERIODS





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OUTCOMES

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

- Demonstrate enhanced reading, thinking, and writing skills by engaging with literary texts.
- Develop finer interpersonal sensibilities and an unbiased understanding of human issues.
- Experience catharsis and emotional reconciliation through literary analysis.
- Identify key figurative devices (metaphor, simile, irony, conceit) and emotional dimensions in poetry.
- Analyze dramatic performance, features of tragedy, comedy, satire, and narrative structures.

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23MDC503

FILM APPRECIATION

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OBJECTIVES

- To introduce the development of film as an art and entertainment form.
- To explore the century-long evolution of film language, movement, and form.
- To instruct students on how to read a film text and appreciate its structural nuances.
- To examine technical components including equipment, screenplays, roles, and the filmmaking process.
- To guide students in studying film theory, criticism, and visual storytelling joyfully.

Theme – A: The Component of Films

- A-1: The material and equipment
- A-2: The story, screenplay and script
- A-3: The actors, crew members, and the director
- A-4: The process of film making... structure of a film

Theme – B: Evolution of Film Language

- B-1: Film language, form, movement etc.
- B-2: Early cinema... silent film (Particularly French)
- B-3: The emergence of feature films: Birth of a Nation
- B-4: Talkies

Theme – C: Film Theories And Criticism/Appreciation

Theme – D: Development of Films

- D-1: Representative Soviet films
- D-2: Representative Japanese films
- D-3: Representative Italian films
- D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

- E-1: The early era
- E-2: The important films made by the directors
- E-3: The regional films
- E-4: The documentaries in India

READING: A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

TOTAL: 30 PERIODS





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OUTCOMES

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

- Explain the roles of materials, crew members, screenplays, and directors in film production.
- Trace the historical transition from silent cinema and early French films to talkies and feature films.
- Apply visual and auditory cinematic language to "read" films as complex texts.
- Evaluate film theories and engage in critical film appreciation.
- Demonstrate an understanding of storytelling structure and narrative techniques in modern cinema.


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23MDC504

DISASTER RISK REDUCTION AND MANAGEMENT

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OBJECTIVES

- To impart knowledge on core concepts of hazards, vulnerability, resilience, and disaster risks.
- To familiarize students with international frameworks (Sendai Framework) and community-based risk reduction strategies.
- To explain the legislative, policy, and institutional frameworks governing disaster management in India.
- To introduce tools, technology, and early warning systems used in preparedness and damage assessment.
- To build practical response skills using case studies, field work, and mock drills.

UNIT I HAZARDS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced – Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India

UNIT II DISASTER RISK REDUCTION (DRR)

Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA- DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of





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GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyze the potential impacts and actions in the contest of disasters-Landslide Hazard Donation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill.

TOTAL: 30 PERIODS

OUTCOMES

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

- Categorize natural, human-induced, and climate-related disasters and assess India's vulnerability profile.
- Formulate disaster risk reduction measures using structural, non-structural, and indigenous methods.
- Understand institutional roles (NDMA, SDMA, DDMA) and legal provisions under the Disaster Management Act (2005).
- Apply GIS, information technology, and standard operating procedures for risk assessment and relief planning.
- Perform damage assessments and participate in mock drills, practical response plans, and field interventions.


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23MDC505

CONSTITUTION OF INDIA

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OBJECTIVES

- Understand the meaning of the Constitution law and Constitutionalism.
- Realize the fundamental rights.
- Understand the execution power so union and states about.
- Be aware of the Constitutional powers.
- Acquaint with other Constitutional functionaries.

UNIT I INTRODUCTION

Meaning of the Constitution law and constitutionalism - Historical perspective of the Constitution of India - Preamble - Salient features and characteristics of the Constitution of India - Citizenship.

UNIT II FUNDAMENTAL RIGHTS

Scheme of the fundamental rights - The scheme of the fundamental duties and its legal status - The directive principles of state policy - Its importance and implementation.

UNIT III UNION AND STATE EXECUTIVE

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary form of Government in India - The Constitution powers and status of the President of India - Governor - Appointment, powers and functions.

UNIT IV CONSTITUTIONAL POWERS

Amendment of the Constitutional powers and procedure - The historical perspectives of the Constitutional amendments in India - Emergency provisions : National emergency, President's rule, financial emergency.

UNIT V OTHER CONSTITUTIONAL FUNCTIONARIES

Election Commission of India: Organization, powers and functions, Union Public Service Commission, State Public Service Commission - Local Self Government.

TOTAL: 30 PERIODS





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OUTCOMES

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

- Understand the salient features and characteristics of the Constitution of India.
- Analyze the scheme of the fundamental rights and duties.
- Evaluate in detail the powers between the Union and the States.
- Know the concept of Constitutional powers.
- Recognize other Constitutional functionaries.

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MANDATORY COURSES II

23MDC601

**WELL-BEING WITH TRADITIONAL PRACTICES-
YOGA, AYURVEDA AND SIDDH**

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OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handbill every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I HEALTH AND ITS IMPORTANCE

Definition - Importance of maintaining health - More importance on prevention than treatment
Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional health

UNIT II DIET

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes - arthritis - hypertension - PCOD - infertility - ADHD - sleeplessness - helps to reduce the risk of heart diseases - keeps the teeth and bones strong
Balanced Diet and its 7 Components - Carbohydrates - Proteins - Fats - Vitamins - Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy. Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.





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Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Panchcheekarana Theory / (Five Element Theory) 96 fundamental Principles - UyirThathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life - Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness - Sleep and digestion. Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL: 30 PERIODS

OUTCOMES

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

- Identify and explain the ten types of health, including physical, mental, emotional, spiritual, and environmental health.
- Analyze the role of a balanced diet and its 7 components in preventing lifestyle disorders like diabetes, hypertension, and arthritis.
- Understand the principles of Siddha and Ayurveda systems, including the Five Element Theory, Tri-Dosha Theory, and daily/seasonal regimens (Dinacharya/Ritucharya).
- Apply stress management techniques, sleep hygiene practices, and emotion-regulation strategies to enhance mental wellness.
- Demonstrate basic yogasanas and understand the Eight Limbs of Yoga for health disorder prevention and cure.


Chairman - BoS





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23MDC602

HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA



LT P C

3 0 0 0

OBJECTIVES

- To enjoy life happily with fun filled new style activities that help to maintain health also.
- To adapt a few lifestyle changes that will prevent many health disorders.
- To be cool and handle every emotion very smoothly in every walk of life.
- To learn to eat cost effective but healthy foods that are rich in essential nutrients.
- To develop immunity naturally that will improve resistance against many health disorders.

UNIT I CONCEPTS AND PERSPECTIVES

Meaning of History Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism. Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmapal, Debiprasad Chattopadhyay, Rehman, S. Ifan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period Beginning of agriculture and its impact on technology Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA

Legacy of technology in Medieval India, Interactions with Arabs Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences Science and Technology on the eve of British conquest

UNIT V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA

Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

Science and Technology In A Post-Independent India

Science, Technology and Development discourse Shaping of the Science and Technology Policy Developments in the field of Science and Technology Science and technology in globalizing India Social implications of new technologies like the Information Technology and Biotechnology.

TOTAL: 30 PERIODS





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OUTCOMES

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

- Explain the concepts, perspectives, and significance of history, science, and technology in India.
- Examine the contributions of major historians to the historiography of science and technology in India.
- Analyze the development of science and technology in Ancient and Medieval India and their societal contributions.
- Analyze the influence of colonial rule on scientific progress and institutional development in India.
- Evaluate the advancements in science and technology in post-independent India and their impact on development and globalization.



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23MDC603 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY

LT P C

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OBJECTIVES

- Define key historical concepts like determinism, relativism, causation, and historical positivism as applied to science and technology.
- Recognize the historiographical contributions of scholars such as D.D. Kosambi, Dharampal, and Debiprasad Chattopadhyay.
- Explain the technological advancements made during ancient and medieval Indian history, including interactions with Arabic sciences.
- Evaluate the growth of techno-scientific institutions and the Indian response to Western science during the colonial period.
- Assess the social implications of emerging technologies and science policy decisions in post-independent and globalizing India.

COURSE TOPICS

Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam Smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives.

Relationship with nature. (6 lectures)

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society.

Future directions. **(4 lectures)**

(Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

Conclusion **(2 lectures)**

TOTAL: 30 PERIODS





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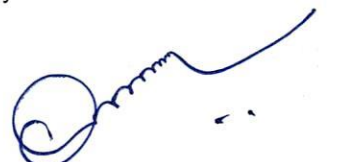
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OUTCOMES

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

- Understand the core considerations required for a humane society and achieving harmony across self, society, and nature.
- Compare the theoretical foundations and historical implementations of free-market capitalism, imperialism, and communism.
- Analyze the relation between human desires, empowerment, satisfaction, and the mechanisms of a welfare state.
- Apply Gandhian economic and political thought (Swaraj, decentralized polity) to contemporary societal and environmental challenges.
- Evaluate future directions for society by considering technology as a driver and education.


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23MDC604

STATE, NATION BUILDING AND POLITICS IN INDIA

L T P C

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OBJECTIVES

- To provide an understanding of the state, its main organs (Executive, Legislature, Judiciary), separation of powers, and the concept of sovereignty.
- To acquaint students with the legacies of the national movement and constitutional development in India.
- To explain the reasons for adopting a Parliamentary-federal system and the broad philosophy of the Constitution of India.
- To examine the changing nature of the Indian political system, new social movements, and challenges to nation-building.
- To discuss issues concerning national integration and nation-building with the aim of developing a future vision for better governance.

TOPICS

Understanding the need and role of State and politics. Development of Nation-State, sovereignty, sovereignty in a globalized world. 183 Organs of State – Executive, Legislature, Judiciary. Separation of powers forms of government unitary-federal, Presidential-Parliamentary, and The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.

Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system? National integration and nation-building

Challenges of nation-building – State against democracy (Kothari) New social movements. The changing nature of Indian Political System, the future scenario. What can we do?

OUTCOMES

- Understand the theoretical aspects of the state, its organs, operationalization, and sovereignty in a globalized world.
- Explain the historical background, philosophy, goals, and objectives behind the founding of the Indian Constitution.
- Analyze the rationale behind adopting a federal-parliamentary system and the broad streams of national integration.
- Identify major challenges to nation-building, social movements, and institutional difficulties within the democratic setup.
- Devise perspectives for active participation in the system to improve governance and delivery for the common citizen.

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23MDC605

INDUSTRIAL SAFETY

L T P C

3 0 0 0

OBJECTIVES

- To understand the introduction and basic terminologies of safety.
- To enable the students to learn about the important statutory regulations and standards.
- To enable students to conduct and participate in various safety activities in the industry.
- To have knowledge about workplace exposures and hazards.
- To assess various hazards and consequences through various risk assessment techniques

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY Noise hazard- Particulate matter- musculoskeletal disorder improper sitting posture and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- 217 Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL: 30 PERIODS





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OUTCOMES

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

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

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MINOR DEGREE / HONOURS





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DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS 2023

(REVISION I)

MINOR DEGREE / HONOURS

INTERNET OF THINGS

CURRICULUM AND SYLLABI



Estd. 2001





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CURRICULUM AND SYLLABI FOR B.E. / B.Tech. DEGREE PROGRAMMES (MINOR/HONOURS DEGREE-INTERNET OF THINGS)

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	Name of the Subject	Category	Periods /Week			Credit	Maximum Marks			
			L	T	P		C	CIA	ESE	TOT
THEORY										
23ECIT01	Introduction to Internet of Things	PC	3	0	0	3	40	60	100	
23ECIT02	VLSI For IoT Systems	PC	3	0	0	3	40	60	100	
23ECIT03	Industrial IoT and Industry 4.0	PC	3	0	0	3	40	60	100	
EMBEDDED COURSE										
23ECIE01	IoT with Arduino, ESP, and Raspberry Pi	PC	3	0	2	4	50	50	100	
EMPLOYABILITY ENHANCEMENT COURSE										
23EEIP01	Project Work	EEC	0	0	12	6	60	40	100	
Total			19							

- 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





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SEMESTER III

23ECIT01

INTRODUCTION TO INTERNET OF THINGS

L T P C
3 0 0 3

OBJECTIVES

- To introduce the concept of IoT ecosystem and its applications.
- To impart knowledge on M2M technologies relating to the IoT.
- To expose reference model and IoT architecture.
- To familiarize students on IoT industrial applications.
- To acquire insights in to IoT privacy and security issues.

UNIT I FUNDAMENTALS OF IoT

9

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy, IoT Related standardization.

UNIT II M2M COMMUNICATION

9

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview.

UNIT III IoT ARCHITECTURE

9

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

UNIT IV IoT INDUSTRIAL APPLICATIONS

9

IoT Applications for Value Creation Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry.

UNIT V IoT PRIVACY AND SECURITY ISSUES

9

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data aggregation for the IoT in Smart Cities.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the technology and standards of IoTs.
- Implement machine to machine communication.
- Design a critical ecosystem required to mainstream IoTs.
- Discuss the skills on developing their smart applications and Business to Master IoT.
- Examine the privacy and security issues of IoTs.

TEXT BOOKS

1. Nitesh Dhanjani, "Abusing the Internet of Things", Shroff Publisher/O'Reilly Publisher, 2015.
2. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan, "Internet of Things" John Wiley and Sons, 2019.

REFERENCES

1. Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, "Internet of Things", John Wiley & Sons, 2019.
2. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media, 2011.

E - RESOURCES

1. <https://archive.nptel.ac.in/courses/106/105/106105166/> (Introduction To Internet of Things)
2. [https://freevideolectures.com/course/4638/nptel-introduction-internet-things\(Interoperability in IoT, Introduction to Arduino Programming\)](https://freevideolectures.com/course/4638/nptel-introduction-internet-things(Interoperability%20in%20IoT,%20Introduction%20to%20Arduino%20Programming))

Mapping of COs-POs & PSOs

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

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


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SEMESTER IV

23ECIT02

VLSI FOR IOT SYSTEMS

L P T C
3 0 0 3

OBJECTIVES

- To introduce the fundamental concepts and architecture of IoT systems.
- To impart knowledge of the key components and building blocks of IoT systems.
- To familiarize the fabrication processes involved in IC technology relevant to IoT applications.
- To provide the system design principles for developing IoT-based solutions.
- To inculcate various IoT systems and their real-world applications.

UNIT I INTRODUCTION

9

Concept of connected world, Need, Legacy systems for connected world, features and limitations, key features of IoT architecture, Merits and Demerits of IoT Technology, Applications driven by IoT technology, examples.

UNIT II COMPONENTS OF IOT

9

Review of classic embedded system architecture, Basic building blocks of an IoT system, Sensors and computing nodes. Sensors used in IoT Systems, Characteristics and requirements, Types of sensors for IoT systems, Compute nodes of IoT, Connectivity technologies in IoT, Software in IoT systems, features and properties.

UNIT III IC TECHNOLOGY FOR IOT

9

SoC Architecture for IoT devices, Application processor, microcontrollers, smart analog, memory architecture for IoT, Non volatile memories(NVM), Embedded non volatile memories, Power management, Low drop out regulators, DC-to DC Converters, Voltage References, Power Management Units(PMUs) in IC's and Systems, Role of Field Programmability in IoT systems.

UNIT IV ELECTRONIC SYSTEM DESIGN FOR IOT

9

Electronic system Design for IoT, Requirements, Computing blocks in IoT systems, MCU's, DSPs and FPGA's, System power supply design for IoT systems, Mixed signal challenges in hardware systems.

UNIT V ANALYSIS OF IOT SYSTEMS

9

Component models and System Design, Feasibility and challenges, System level integration, Operating conditions of IoT devices and impact on Electronic System design, hardware security issues, EMI/EMC, SI/PI and Reliability analysis in IoT systems.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Examine the depth knowledge about the architecture of IoT systems.
- Apply the components used in building blocks and IoT systems.
- Explain the SoC architectures for IoT and its memories.
- Design computing blocks used in IoT systems.
- Analyze the component models of IoT systems and hardware security issues.

TEXT BOOKS

1. Alloto, "Enabling the internet of Things from Integrated Circuits to Integrated systems", Springer Publications, First Edition, 2017.
2. Pieter Harpe, Kofi A.A makinwa Andrea Baschiroto, " Hybrid ADCs, Smart sensors for the IoT, and sub-1V& Advanced Node analog circuit Design", Springer International Publishing AG,2017.

REFERENCES

1. Rashid khan, Ajithvasudevan, "Learning IoT with Particle Photon and Electron", Packt Publishing Limited (Verlag), 2016.
2. Apek Mulay, "Sustaining Moore's Law: Uncertainty Leading to a certainty of IoT Revolution", Margan and Claypool Publishers, 2015.

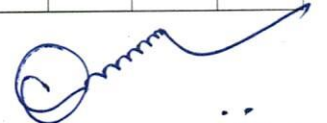
E-RESOURCES

1. <https://nptel.ac.in/courses/108/108/108108111/> (Introduction of IC)
2. <https://www.digimat.in/nptel/courses/video/108101089/l21.html> (Fabrication of MOS)

Mapping of COs-POs & PSOs

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

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


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SEMESTER V

23ECIT03

INDUSTRIAL IOT AND INDUSTRY 4.0

L T P C

3 0 0 3

OBJECTIVES

- To discuss the characteristics of various sensors and its applications.
- To introduce the communication protocol used in IoT development.
- To expose physical devices and controlling hardware, temperature used in IoT.
- To familiarize students in IoT cloud dashboards and web services.
- To obtain in depth knowledge on IoT system design – Hardware & Software.

UNIT I IOT CONCEPT AND DEVELOPMENT PLATFORM

9

IOT Definition, Importance of IoT, Applications of IOT, IoT architecture, Understanding working of Sensors, Actuators, Sensor calibration, Study of Different sensors and their characteristics.

UNIT II COMMUNICATION PROTOCOL USED IN IOT DEVELOPMENT

9

UART Communication Protocol, I2C Protocol device interfacing and decoding of signal, SPI Protocol device interfacing and decoding of signal, WIFI and Router interfacing, Ethernet Configuration, Bluetooth study and analysis of data flow, Zigbee Interfacing and study of signal flow.

UNIT III IOT PHYSICAL DEVICES AND END POINTS HARDWARE AND SENSORS

9

IoT Physical Devices and Endpoints- Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors; Sensors- Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Distance Measurement with ultrasound sensor.

UNIT IV CLOUD SERVICES USED IN IOT DEVELOPMENT PLATFORM

9

Configuration of the cloud platform, Sending data from the IOT nodes to the gateways using different communication options; Transferring data from gateway to the cloud; Exploring the web services like mail, Messaging (SMS) and Twitter etc.; Tracking of cloud data as per the requirement; Google Cloud service architect.

UNIT V CHALLENGES IN IOT SYSTEM DESIGN – HARDWARE AND SOFTWARE

9

Antenna design and placement, Chip-package system development, Power electronics, electromagnetic interference/compatibility (EMI/EMC), Electronics reliability; Battery simulation.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the building blocks of IoT technology and sensors calibration.
- Describe the processors and peripherals used in IoT communication protocol.
- Apply commonly used IoT protocols such as REST, API, MQTT through IoT based sensors.
- Design IOT applications with the physical world of humans and real life problem solving.
- Implement IOT applications in antenna and battery simulation.

TEXT BOOKS

- Arshdeep Bahga and Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
- Matt Richardson & Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 2014.

REFERENCES

- Simon Monk, O'Reilly (SPD), Raspberry Pi Cookbook, "Software and Hardware Problems and solutions", 2016,
- N. Ida, Sensors, "Actuators and their Interfaces", SciTech Publishers, 2014.

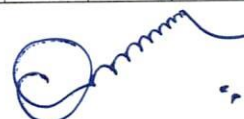
E-RESOURCES

- <https://archive.nptel.ac.in/courses/106/105/106105166/> (Introduction to IoT)
- https://onlinecourses.nptel.ac.in/noc20_cs69/preview (Introduction to Industry 4.0 and Industrial Internet of Things)

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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SEMESTER VI

23ECIE01

IoT WITH ARDUINO, ESP, AND RASPBERRY PI

L T P C

3 0 2 4

OBJECTIVES

- To introduce building blocks of IoT devices and boards.
- To inculcate the concept of arduino boards and its Interfacing.
- To expose the fundamentals of ESP 8266 and its applications.
- To knowledge about the Raspberry and ES 8266 and its Interfacing.
- To enhance knowledge on Rsspery PI3 configuration without Ethernet.
- To provide skills for interfacing sensors and actuators with different IoT architectures.

UNIT I INTRODUCTION

9

IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).

UNIT II INTRODUCTION TO ARDUINO UNO

9

Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.

UNIT III GETTING STARTED WITH THE ESP BOARD

9

ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplorer IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API- GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).

UNIT IV RASPBERRY PI 3 AND ITS CONFIGURATION

9

Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.

UNIT V RASPBERRY PI3 INTERFACING WITH SENSOR

9

Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Model B Comparison, LoRawan /LPWAN – Overview.





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LIST OF EXPERIMENTS

1. Introduction to Arduino Uno R3.
2. Blinking the LED with Arduino.
3. Read the analog voltage using ADC on Arduino.
4. Measure the distance of an object using ultrasonic sensor.
5. Getting started with Raspberry Pi, Install Raspian on your SD card.
6. Coding simple programs in Python.
7. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
8. Raspberry Pi interacts with online services through the use of public APIs and SDKs.
9. Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application to detect obstacle and notify user using LEDs.

TOTAL: 45+15= 60 PERIODS

OUTCOMES

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

- Design arduino Uno, NODE MCU 8266 and Raspberry PI along with critical protocols and its communication to cloud.
- Explain the Interfacing module of sensors and arduino board .
- Apply ESP8266 board with micropython used in sensors and ESP board.
- Analyze the Raspberry PI 3 and its configuration.
- Implement analog sensor and digital sensor interfacing with IOT devices.
- Develop skills on hands-on experience using arduino and Raspberry Pi.

TEXT BOOKS

1. Rao, M., "Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects", Packt Publishing Ltd, 2018.
2. Baichtal, J. "Arduino for beginners: essential skills every maker needs", Pearson Education, 2013.

REFERENCES

1. Schwartz, M. "Internet of Things with ESP8266", Packt Publishing Ltd, 2016.
2. Richardson, M., & Wallace, S., "Getting started with raspberry PI", O'Reilly Publisher Media, Inc., 2012.

E-RESOURCES

1. <https://nptel.ac.in/courses/106105166> (Introduction to Internet of things)
2. <https://nptel.ac.in/courses/106105193> (Embedded system design with ARM)





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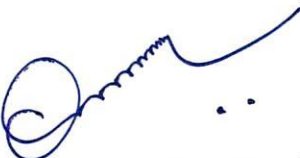
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Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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SEMESTER VII

23ECIP01

PROJECT WORK

L T P C
0 0 12 6

OBJECTIVES

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To build up skills to formulate a technical project.
- To develop the methodology to solve the identified problem.
- To teach use of new tools, algorithms and techniques required to carry out the projects
- To train the students in preparing project reports and to face reviews and viva-voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOMES

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

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Prepare technical report and oral presentations.
- Learn the students will have a clear idea of their area of work and a systematic way.





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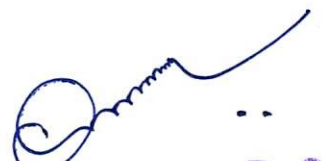
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AVG	3	2	2	2	2	1	-	2	2	2	2	3	2

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DEPARTMENT OF

ELECTRONICS AND COMMUNICATION ENGINEERING

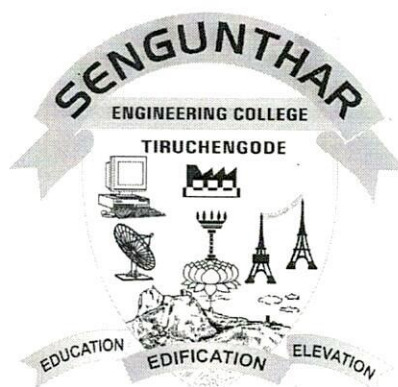
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(REVISION I)

MINOR DEGREE / HONOURS

ROBOTICS

CURRICULUM AND SYLLABI



Estd. 2001





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CURRICULUM

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

(MINOR/HONOURS DEGREE- ROBOTICS)

B.E. – ELECTRONICS AND COMMUNICATION ENGINEERING

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P		C	CIA	ESE
THEORY									
23ECRT01	Principles of Robotics	PC	3	0	0	3	40	60	100
23ECRT02	Wireless Sensors Networks for Robotics	PC	3	0	0	3	40	60	100
23ECRT03	Artificial Intelligence for Robotics	PC	3	0	0	3	40	60	100
EMBEDDED COURSE									
23ECE01	Microcontrollers for Robotics	PC	3	0	2	4	50	50	100
EMPLOYABILITY ENHANCEMENT COURSE									
23ECP01	Project Work	EEC	0	0	12	6	60	40	100
Total			19						

- 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





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23ECRT01

SEMESTER III PRINCIPLES OF ROBOTICS

L T P C

3 0 0 3

OBJECTIVES

- To introduce the basic terminologies of the robotics.
- To acquire knowledge about sensors used in robotics.
- To enhance knowledge on sensors drives and controllers.
- To inculcate the programming skills of robotics and Languages.
- To familiarize students in Economical aspects in robot design.

UNIT I INTRODUCTION TO ROBOTICS

9

Brief History-Basic Concepts of Robotics such as Definition - Three laws, Elements of Robotic Systems - Robot anatomy-DOF-Misunderstood devices -Classification of Robotic systems on the basis of various parameters such as work volume- type of drive-Associated parameters- 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 systems, 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 APPLICATIONS

9

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

TOTAL: 45 PERIODS





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OUTCOMES

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

- Explain terminologies related to Robotics technology.
- Examine the classification of sensors used in Robotics
- Apply logic for selection of robotic subsystems and systems
- Analyze basic principles of robot system integration.
- Implement applications of robotics used in Artificial Intelligence.

TEXTBOOKS

1. Dilip Kumar Pratihari, "Fundamentals of Robotics", Narosa Publishing House, 2019.
2. S.B.Niku, "Introduction to Robotics – Analysis", Contro, Applications, John Wiley & Sons Ltd. Third Edition, 2020.

REFERENCES

1. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, "Industrial Robotics SIE", McGraw Hill Education India Pvt Ltd, Second Edition, 2012.
2. S.K.Saha, "Introduction to Robotics", TATA McGraw Hills Education, Second Edition, 2014.

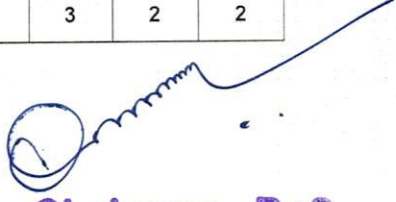
E-RESOURCES

1. <https://nptel.ac.in/courses/107106090> (Introduction to Robotics)
2. <https://nptel.ac.in/courses/108108147> (Sensors and Actuators)

Mapping of COs-POs & PSOs

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

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


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SEMESTER IV

23ECRT02

WIRELESS SENSORS NETWORKS FOR ROBOTICS

L P T C

3 0 0 3

OBJECTIVES

- To introduce the basics of wireless sensor networks.
- To expose the architecture and tools used in networking.
- To gain the knowledge in networking using sensors.
- To enhance knowledge in wireless architecture establishment.
- To inculcate the different sensor techniques used in networking.

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS

9

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks.

UNIT II ARCHITECTURES

9

Joint distributions Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS

9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing..

UNIT IV INFRASTRUCTURE ESTABLISHMENT

9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

9

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TOTAL: 45 PERIODS





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OUTCOMES

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

- Analyze the different techniques used in networking.
- Examine the basics in wireless architecture.
- Describe the fundamental concepts of sensor networks.
- Implement the protocols used in networking and clustering.
- Analyze the different tools used in networking.

TEXTBOOKS

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.

REFERENCES

1. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2011.
2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

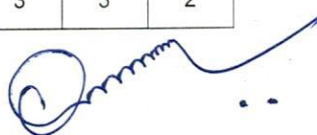
E-RESOURCES

1. <https://nptel.ac.in/courses/106105160> (Wireless Sensor Networks).
2. <https://nptel.ac.in/courses/117104118> (Estimation for Wireless Communications).

Mapping of COs-POs & PSOs

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SEMESTER V

23ECRT03

ARTIFICIAL INTELLIGENCE FOR ROBOTICS

L P T C

3 0 0 3

OBJECTIVES

- To introduce the basics of artificial intelligence and satisfaction problems.
- To impart knowledge on planning acting in real world using artificial intelligence.
- To enhance knowledge in reasoning concepts of machine learning.
- To expose the methods of solving problems using Artificial Intelligence.
- To acquire insights in to ethics and risks of Artificial Intelligence in robotics.

UNIT I INTRODUCTION

9

State Of the Art, Need for AI in Robotics. Thinking And Acting Humanly, Intelligent Agents, Structure Of Agents. PROBLEM SOLVING: Solving Problems by Searching –Informed Search and Exploration– Constraint Satisfaction Problems–Adversarial Search, Knowledge and Reasoning– Knowledge Representation – First Order Logic.

UNIT II PLANNING

9

Planning with forward and backward State space search – Partial order planning – Planning graphs Planning with propositional logic – Planning and acting in real world.

UNIT III REASONING

9

Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks, Speech recognition, making decisions.

UNITIV LEARNING

9

Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

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





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OUTCOMES

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

- Explain the appropriate AI methods to solve a given problem.
- Examine the problems that are amenable to solution by AI methods.
- Analyze the given problem in the language/framework of different AI methods.
- Implement reinforcement and perception learning used AI algorithms
- Design empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

TEXTBOOKS

1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A modern approach", Pearson Education, India, Third Edition, 2016.
2. Negnevitsky, M, "Artificial Intelligence: A guide to Intelligent Systems", Harlow: Addison Wesley, Second Edition, 2002.

REFERENCES

1. Francis.X.Govers, "Artificial Intelligence for Robotics", Packt Publishing, Second Edition, 2018.
2. Huimin Lu, Xing Lu, "Artificial Intelligence and Robotics", Springer, First Edition, 2017.

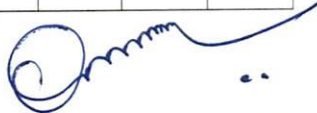
E-RESOURCES

1. [https://nptel.ac.in/courses/106105077-\(Artificial Intelligence\)](https://nptel.ac.in/courses/106105077-(Artificial%20Intelligence))
2. [https://nptel.ac.in/courses/106105078-\(Probabilistic Reasoning\)](https://nptel.ac.in/courses/106105078-(Probabilistic%20Reasoning))

Mapping of COs-POs & PSOs

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SEMESTER VI

23ECE01

MICROCONTROLLERS FOR ROBOTICS

LT P C

3 0 2 4

OBJECTIVES

- To introduce the fundamental concept of microcontroller.
- To gain knowledge in basic architecture and instruction set of AVR microcontroller.
- To enhance knowledge in assembly and C programming using Data types.
- To acquire knowledge on AVR in –chip peripherals and its programming
- To expose the interfacing concepts using sensors and motors.
- To write a programming using AVR Microcontroller and interfacing with Arduino UNO board.

UNIT I FUNDAMENTALS OF MICROCONTROLLERS

9

History of microprocessor and microcontrollers, Difference between microprocessors and microcontrollers and Applications of microcontrollers, Comparison of 8-bit microcontrollers-16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics - Role of microcontrollers in embedded Systems. Overview of the 8051 family Role of microcontrollers in embedded Systems. Introduction to Microcontroller Interfacing and applications.

UNIT II ARCHITECTURE AND INSTRUCTION SET OF 8-BIT AVR MICROCONTROLLER

9

AVR Microcontroller architecture Registers, AVR status register, Memory Space, ATmega32(Arduino) pin-configuration & function of each pin, Addressing mode and instruction set AVR microcontroller, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, Bit manipulation instructions.

UNIT III AVR ASSEMBLY AND C PROGRAMMING

9

AVR data types and assembler directives, AVR assembly language programs, AVR I/O Port, Programming, Time delay loop, Bit addressability, MACROs, Pros and cons of C and assembly language programming, Data types, Simple C programs for general purpose I/O and bit accessibility.

UNIT IV AVR ON-CHIP PERIPHERALS AND ITS PROGRAMMING

9

AVR on-chip peripherals and its programming: General purpose I/O Ports, Timers, Interrupts, serial port, Serial port Interfacing protocols, SPI, I2C, UART. Assembly and C Language programming for peripherals.

UNIT V DEVICE INTERFACING AND ITS PROGRAMMING

9

Sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing, Industrial servo interfacing, Raspberry Pi based programming for robots. Inverse Kinematics and Path Planning Programming using ROS





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LIST OF EXPERIMENTS

1. Introduction to Robotic controller card like Arduino UNO board and write program to blink LED using Arduino instructions, C language & Assembly language
2. Interfacing drivers for Arduino Controller for Robotic application. Various sensor interfacing with Robotic Controller like Arduino UNO board
3. Interfacing Seven Segment Display/ Alphanumeric Display.
4. ADC operation of Arduino using Potentiometer and Display.
5. Interface Stepper motor with AVR Microcontroller and Write program to rotate stepper motor in clockwise and anticlockwise direction.
6. Write Arduino program to receive IR Signal from IR remote and operate Electrical device based on switch pressed.
7. Write and execute Arduino program for serial communication. Transmit temperature value through serial communication and store it in spreadsheet or text file.
8. Toggle the ON/OFF status of an LED with a Switch.

TOTAL: 45+15=60PERIODS

OUTCOMES

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

- Obtain the fundamental concepts of microcontrollers.
- Develop programming skills to implement AVR microcontrollers..
- Implement Arduino controller for robotic application with Microcontroller.
- Design AVR on-chip Peripherals.
- Choose appropriate sensors and motors for embedded applications.
- Develop and implement C- language programming for Microcontroller applications.

TEXTBOOKS

1. Muhammad Ali Mazidi, SarmadNaimi and SepehrNaimi, "The AVR Microcontroller and Embedded Systems", Using Assembly and C, Pearson Education, First Edition, 2012.
2. S. K. Saha, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2008.

REFERENCES

1. R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd, 2017.
2. M.Morris Mano, "Computer System Architecture", Pearson Publication, Third Edition, 2007.





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E-RESOURCES

1. <https://nptel.ac.in/courses/117104072> - (Microcontroller).
2. <https://nptel.ac.in/courses/106106210> - (Programming and assembly language).

Mapping of COs-POs & PSOs

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

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


Chairman - BoS





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23ECRP01

SEMESTER VII PROJECT WORK

L T P C
0 0 12 6

OBJECTIVES

- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- To build up skills to formulate a technical project.
- To develop the methodology to solve the identified problem.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To train the students in preparing project reports and to face reviews and viva-voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 180 PERIODS

OUTCOMES

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

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Prepare technical report and oral presentations.
- Learn the students will have a clear idea of their area of work and a systematic way.





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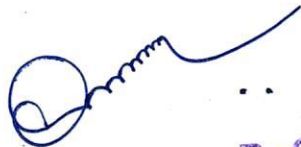
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Mapping of COs-POs & PSOs

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

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


Chairman - BoS



SCHEME

Credit Summary





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FOR B.E./B.Tech. DEGREE PROGRAMMES (MINOR DEGREE /HONOURS)

CREDIT SUMMARY

B.E.- ELECTRONICS AND COMMUNICATION ENGINEERING

Category	Credits Per Semester								Credit Total
	I	II	III	IV	V	VI	VII	VIII	
PC	-	-	6	6	6	8	-	-	26
EEC	-	-	-	-	-	-	12	-	12
Total	-	-	6	6	6	8	12	-	38

