



Sri

SAI RAM

INSTITUTE OF TECHNOLOGY

An Autonomous Institution

West Tambaram, Chennai - 44

www.sairamit.edu.in

*Approved by AICTE, New Delhi
Affiliated to Anna University*



**DEPARTMENT OF
ELECTRONICS AND
COMMUNICATION ENGINEERING**

**REGULATIONS
2020**

Academic Year 2020-21 onwards

**AUTONOMOUS
CURRICULUM AND**

**SYLLABUS
I - VIII
SEMESTERS**

SRI SAIRAM INSTITUTE OF TECHNOLOGY



VISION

To be identified as a “Centre of Excellence” with high standards of Knowledge Dissemination and Research opportunities and to transform the students to imbibe qualities of technical expertise of international standards and high levels of ethical values, who in turn shall contribute to the advancement of society and human kind.



MISSION

We shall dedicate and commit ourselves to attain and maintain excellence in Technical Education through commitment and continuous improvement of infrastructure and equipment and provide an inspiring environment for Learning, Research and Innovation for our students to transform them into complete human beings with ethical and social values.



QUALITY POLICY

We at Sri Sai Ram Institute of Technology are committed to build a better nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Services to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.



VISION

To become a leading department of excellence in academic and research imparting high quality technical education in Electronics and Communication Engineering through international standards and making our students technologically superior and ethically strong to serve the society and mankind.



MISSION

To create an inspiring environment that shall enhance the growth of innovative research professional excellences who can contribute to the society and mankind, ethical and societal values through life-long learning.

AUTONOMOUS CURRICULA AND SYLLABI Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA101	Engineering Mathematics-I	3	1	0	4	4
2	20HSEN101	Technical English-I	3	0	0	3	3
3	20BSPH101	Engineering Physics	3	0	0	3	3
4	20BSCY101	Engineering Chemistry	3	0	0	3	3
5	20ESCS101	Problem Solving and Programming in C	3	0	0	3	3
6	20ESGE101	Engineering Graphics	1	2	0	3	3
PRACTICAL							
7	20BSPL101	Physics and Chemistry Laboratory	0	0	3	3	1.5
8	20ESPL101	Programming in C Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
TOTAL						29	23

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA201	Engineering Mathematics -II	3	1	0	4	4
2	20HSEN201	Technical English - II	3	0	0	3	3
3	20ESIT201	Python Programming with lab	3	0	2	5	4
4	20BSPH201	Physics of Electronic Devices	3	0	0	3	3
5	20ECPC201	Circuit Analysis	3	0	0	3	3
PRACTICAL							
6	20ESGE201	Engineering Practices Laboratory	0	0	3	3	1.5
7	20ECPL201	Circuits and Devices Laboratory	0	0	3	3	1.5
8	20ECTE201	PCB Design	0	0	2	2	1
VALUE ADDITIONS - II							
9	20TPHS201	Skill Enhancement	0	0	2	2	1
10	20HSMG201	Interpersonal Values	2	0	0	2	0
TOTAL						30	22

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC301	Digital Electronics	3	0	0	3	3
2	20ECPC302	Electromagnetic Fields & Waveguides	3	1	0	4	4
3	20ECPC303	Signals and Systems	3	1	0	4	4
4	20ECPW301	R Programming with Laboratory	3	0	2	5	4
5	20BSMA301	Linear Algebra, Partial Differential Equations and Transforms	3	1	0	4	4
PRACTICAL							
6	20ECP301	Digital Circuits Laboratory	0	0	3	3	1.5
7	20ECTE301	Live-in-Lab - I	0	0	2	2	1
VALUE ADDITIONS - III							
8	20ECTP301	Skill Enhancement	0	0	2	2	1
9	20MGMC301	Constitution of India	2	0	0	2	0
TOTAL						28	22.5

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC401	Communication Theory	3	0	0	3	3
2	20ECPW401	Electronic Circuits with Laboratory	3	0	2	5	4
3	20ECPW402	Linear integrated Circuits with Laboratory	3	0	2	5	4
4	20ECPC402	Microcontrollers & Embedded Systems	3	0	0	3	3
5	20BSMA401	Probability theory and Stochastic processes	3	1	0	4	4
6	20BSCY201	Environmental Science and Engineering	3	0	0	3	3
PRACTICAL							
7	20ECP401	Microcontrollers & Embedded Systems Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - IV							
8	20ECTE401	Live-in-Lab -II	0	0	2	2	1
9	20ECTP401	Skill Enhancement	0	0	2	2	1
TOTAL						30	24.5

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC501	Digital Communication	3	0	0	3	3
2	20ECPW501	Discrete Time Signal Processing with Laboratory	3	0	2	5	4
3	20ECPC502	VLSI Design	3	0	0	3	3
4	20ECELXXX	Professional Elective-I	3	0	0	3	3
5	20XXOEXXX	Open Elective-I	3	0	0	3	3
PRACTICAL							
6	20ECPL501	Communication Systems Laboratory	0	0	3	3	1.5
7	20ECPL502	VLSI Laboratory	0	0	3	3	1.5
8	20ECTE501	Live-in-Lab III	0	0	4	4	2
VALUE ADDITIONS - V							
9	20ECTP501	Skill Enhancement	0	0	2	2	1
TOTAL						29	22

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC601	Transmission Lines & Antennas	3	0	0	3	3
2	20ECPC602	Communication Networks	3	0	0	3	3
3	20ECPC603	Wireless Communication	3	0	0	3	3
4	20ECELXXX	Professional Elective-II	3	0	0	3	3
5	20XXOEXXX	Open Elective - II	3	0	0	3	3
PRACTICAL							
6	20HSP501	Communication and Soft Skills Laboratory	0	0	2	2	1
7	20ECPL601	Antennas Laboratory	0	0	3	3	1.5
8	20ECPL602	Networks Laboratory	0	0	3	3	1.5
9	20ECPJ601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
10	20ECTP601	Skill Enhancement	0	0	2	2	1
TOTAL						27	21

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC701	RF and Microwave Engineering	3	0	0	3	3
2	20ECPC702	Optical Communication	3	0	0	3	3
3	20CSPC601	Artificial Intelligence	3	0	0	3	3
4	20ECELXXX	Professional Elective-III	3	0	0	3	3
5	20HSMG601	Principles of Engineering Management	3	0	0	3	3
PRACTICAL							
6	20ECPL701	Advanced Communication Laboratory	0	0	3	3	1.5
7	20CSPL601	Artificial Intelligence Laboratory	0	0	3	3	1.5
8	20ECPJ701	Project Phase - I	0	0	4	4	2
VALUE ADDITIONS - VII							
9	20ECTP701	Skill Enhancement	0	0	2	2	1
TOTAL						27	21

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECELXXX	Professional Elective - IV	3	0	0	3	3
PRACTICAL							
2	20ECPJ801	Project Phase - II	0	0	8	8	4
TOTAL						11	7

CREDIT DISTRIBUTION

Category	BS	ES	HS	EL	PC+PL	PW	OE	TE	PJ	TP	IS	MC	TOTAL
Credit	29.5	13	10	12	57.5	16	6	5	7	7	3	Y	166
Percentage	17.8	7.8	6.0	7.2	34.6	9.6	3.6	3.0	4.2	4.2	1.8	-	

*IS-Internship

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECE501	Advanced Communication Systems and Techniques	3	0	0	3	3	Wireless
2	20ECE502	Industrial IOT	3	0	0	3	3	Wireless
3	20ECE503	FPGA & ASIC Design	3	0	0	3	3	VLSI
4	20ECE504	Programmable Logic Controllers	3	0	0	3	3	VLSI
5	20ECE505	Television and Broadcasting Services	3	0	0	3	3	RF & Green
6	20ECE506	Sensors and RFID	3	0	0	3	3	RF & Green
7	20ECE507	Sensors and measurements	3	0	0	3	3	Signal Processing
8.	20ECE508	Biosignal and Image Processing	3	0	0	3	3	Signal Processing
9.	20ECE509	Soft Computing	3	0	0	3	3	Biomedical
10.	20ECE510	Control Systems Engineering	3	0	0	3	3	Biomedical
11.	20ECE511	Intellectual Property Rights	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM	
			L	T	P				
1	20ECE601	Radio Access Networks	3	0	0	3	3	Wireless	
2	20ECE602	Wireless Sensor Networks	3	0	0	3	3	Wireless	
3	20ECE603	CMOS Analog IC Design	3	0	0	3	3	VLSI	
4	20ECE604	Software for Embedded Systems	3	0	0	3	3	VLSI	
5	20ECE605	Electromagnetic Interference and Compatibility	3	0	0	3	3	RF & Green	
6	20ECE606	Green Radio Communication Networks		3	0	0	3	3	RF & Green
7	20ECE607	Biomedical Instrumentation	3	0	0	3	3	Signal Processing	
8.	20ECE608	DSP Processor Architecture and Programming	3	0	0	3	3	Signal Processing	
9.	20ECE609	Machine Learning Techniques	3	0	0	3	3	Biomedical	
10.	20ECE610	Medical Electronics	3	0	0	3	3	Biomedical	
11.	20ECE611	Total Quality Management	3	0	0	3	3	Management	

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL701	Cognitive Radio	3	0	0	3	3	Wireless
2	20ECEL702	Smart Antennas for Mobile Communication and GPS	3	0	0	3	3	Wireless
3	20ECEL703	Mixed Signal IC Design	3	0	0	3	3	VLSI
4	20ECEL704	Embedded Processor for Signal Processing	3	0	0	3	3	VLSI
5	20ECEL705	Antennas for Modern Communication	3	0	0	3	3	RF & Green
6	20ECEL706	Radar and Navigational Aids	3	0	0	3	3	RF & Green
7	20ECEL707	Pattern Recognition	3	0	0	3	3	Signal Processing
8.	20ECEL708	Brain Computer interface and its applications	3	0	0	3	3	Signal Processing
9.	20ECEL709	Digital Image Processing	3	0	0	3	3	Biomedical
10.	20ECEL710	Deep Learning Principles & Practices	3	0	0	3	3	Biomedical
11.	20ECEL711	Foundation Skills in Integrated Product Development	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL801	5G and 6G Wireless Communication Systems	3	0	0	3	3	Wireless
2	20ECEL802	Underwater Wireless Communication Systems	3	0	0	3	3	Wireless
3	20ECEL803	Electronic Packaging and Testing	3	0	0	3	3	VLSI
4	20ECEL804	Embedded Product Development	3	0	0	3	3	VLSI
5	20ECEL805	Satellite Communication	3	0	0	3	3	RF & Green
6	20ECEL806	Photonic Networks	3	0	0	3	3	RF & Green
7	20ECEL807	Telehealth Technology	3	0	0	3	3	Signal Processing
8.	20ECEL808	Medical Informatics	3	0	0	3	3	Signal Processing
9.	20ECEL809	Robotics and Automation	3	0	0	3	3	Biomedical
10.	20ECEL810	Medical Imaging Systems	3	0	0	3	3	Biomedical
11.	20ECEL811	Professional Ethics and Values	3	0	0	3	3	Management

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1** Acquire strong foundation in Engineering, Science and Technology for a successful career in Electronics and Communication Engineering.
- PEO2** Apply their knowledge and skills acquired to solve the issues in real world Electronics and Communication sectors and to develop feasible and viable systems.
- PEO3** Be receptive to new technologies and attain professional competence through professional society activities.
- PEO4** Participate in lifelong learning, higher education efforts to emerge as expert researchers and technologists.
- PEO5** Practice the profession with ethics, integrity, leadership and social responsibilities.

PROGRAM SPECIFIC OUTCOMES (PSOs)

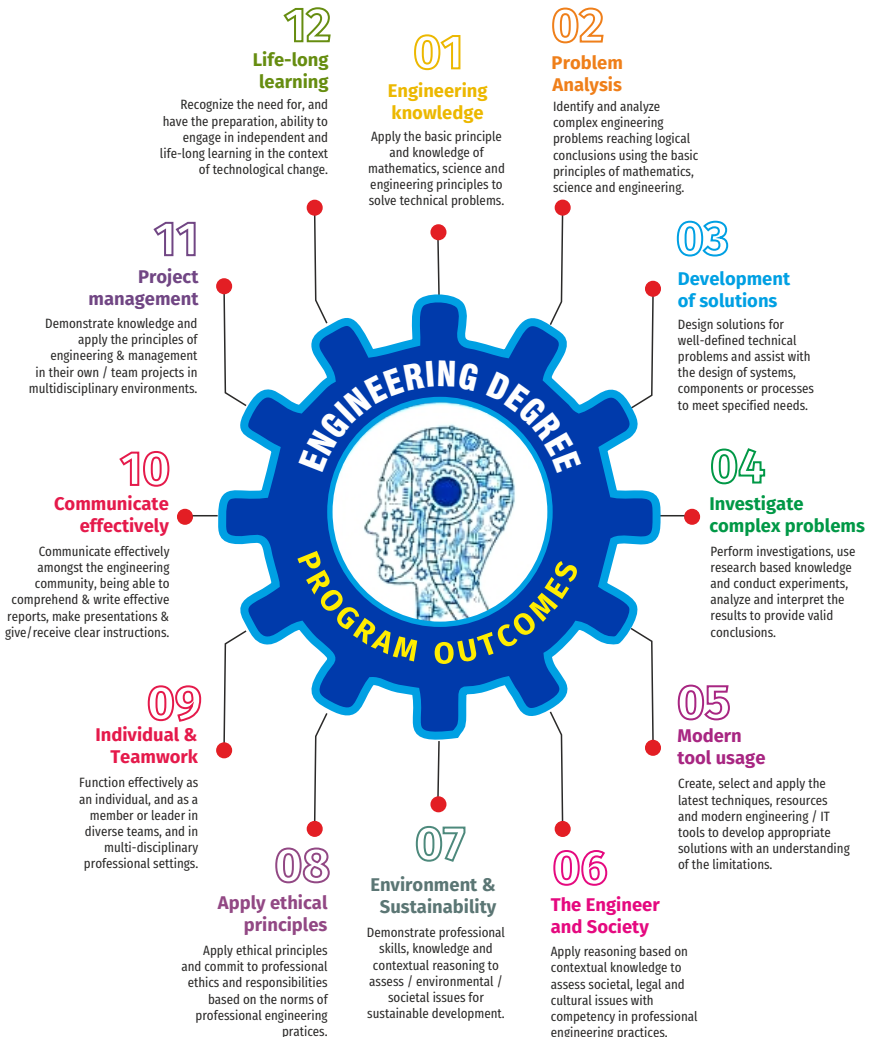
- PSO1** Design, implement and test Electronics and Communication systems using analytical knowledge and applying modern hardware and software tools
- PSO2** Develop their skills to solve problems and assess social, environmental issues with ethics and manage different projects in multidisciplinary areas.

COMPONENTS OF THE CURRICULUM (COC)

Course Component	Curriculum Content (% of total number of credits of the program)	Total number of contact hours	Total Number of credits
Basic Sciences(BS)	17.7	31	29.5
Engineering Sciences(ES)	7.8	17	13
Humanities and Social Sciences (HS)	6.0	16	10
Professional Electives(EL)	9.0	15	15
Program Core+Program Lab (PC+PL)	41.0	84	68.5
Program theory with Lab (PW)	2.4	5	4
Open Electives (OE)	3.6	6	6
Talent Enhancement (TE)	2.4	8	4
Project (PJ)	4.2	14	7
Training & Placement (TP)	4.2	14	7
Internships/Seminars (IS)	1.8	-	3
Mandatory Courses (MC)	NA	2	NA
Total number of Credits		212	167

PROGRAMME OUTCOMES(POs)

PROGRAM OUTCOME REPRESENTS THE KNOWLEDGE, SKILLS AND ATTITUDES THAT THE STUDENTS WOULD BE EXPECTED TO HAVE AT THE END OF THE 4 YEAR ENGINEERING DEGREE PROGRAM



SEMESTER - I

20BSMA101 SDG NO. 4 & 9	ENGINEERING MATHEMATICS-I	L	T	P	C
		3	1	0	4

OBJECTIVES:

The intent of this course is

- The intent of the course is to understand, gain the knowledge of matrix algebra.
- To introduce the concepts of limits, continuity, derivatives and maxima and minima.
- To acquaint the concept of improper integrals and the properties of definite integrals.
- To provide understanding of double integration, triple integration and their application.
- To introduce the concept of sequence and series and impart the knowledge of Fourier series.

UNIT I MATRICES

12

Symmetric, skew symmetric and orthogonal matrices; Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Reduction of a Quadratic form to Canonical form using Orthogonal Transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS

12

Limit, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives, Taylor's series for functions of two variables, Jacobian, Maxima & Minima of functions of several variables, saddle points, Method of Lagrange multipliers.

UNIT III INTEGRAL CALCULUS

12

Evaluation of definite and improper integral - Techniques of Integration-Substitution rule - Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Applications of definite integrals to evaluate surface areas and volumes of revolution.

UNIT IV MULTIPLE INTEGRALS

12

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 and triple integrals.

UNIT V SEQUENCES AND SERIES**12**

Introduction to sequences and series – power series – Taylor's series – series for exponential, trigonometric, logarithmic, hyperbolic functions – Fourier series – Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS**TEXTBOOKS:**

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, "A text-book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2014.

WEB REFERENCES:

1. <https://math.mit.edu/~gs/linearalgebra/ila0601.pdf>
2. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/>
3. <https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/>
4. <http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear-algebra-introduction-to-eigenvalues-and-eigenvectors>
2. <https://www.khanacademy.org/math/differential-calculus>

OUTCOMES:

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

1. Understand the concepts of symmetric, skew symmetric, orthogonal matrices, properties of Eigen values and eigen vectors, the nature of a quadratic form, sequences and series, power series representation of

functions, series representation of exponential, trigonometric logarithmic and hyperbolic functions. (K2)

2. Compute the eigen values, eigen vectors of a matrix, diagonalize the quadratic form using orthogonal transformation and find the inverse and higher powers of a matrix using Cayley Hamilton theorem. (K3)
3. Calculate the limit, derivative, partial derivatives, Jacobians of simple functions and evaluate integrals of single variable using the rules of integration. (K3)
4. Determine the Taylor series representation of functions of one variable and two variables and evaluate maxima and minima of functions of one variable, two variables and several variables. (K3)
5. Evaluate double integrals using change of order technique, double and triple integrals using change of variables technique and calculate surface areas and volume of solids of revolution. (K3)
6. Compute the Fourier series, Sine and Cosine series representation of functions defined in a period and use Fourier series and Parseval's theorem to find the value of infinite series. (K3)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1
CO6	3	3	2	1	-	-	-	-	-	-	-	1

SEMESTER - I

20HSEN101 SDG NO. 4	TECHNICAL ENGLISH - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the basic LSRW skills of the students
- To encourage the learners to adapt to listening techniques
- To help learners develop their communication skills and converse fluently in real contexts
- To help learners develop general and technical vocabulary through reading and writing tasks

- To improve the language proficiency for better understanding of core subjects

UNIT I INTRODUCTION

9

Listening – short texts – formal and informal conversations - **Speaking** – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - **Reading** – critical reading – finding key information in a given text – shifting facts from opinions - **Writing** – free writing on any given topic – autobiographical writing - **Language Development** – tenses – voices- word formation: prefixes and suffixes – parts of speech – developing hints

UNIT II READING AND LANGUAGE DEVELOPMENT

9

Listening - long texts - TED talks - extensive speech on current affairs and discussions - **Speaking** – describing a simple process – asking and answering questions - **Reading** comprehension – skimming / scanning / predicting & analytical reading – question & answers – objective and descriptive answers – identifying synonyms and antonyms - process description - **Writing** instructions – **Language Development** – writing definitions – compound words - articles – prepositions

UNIT III SPEAKING AND INTERPRETATION SKILLS

9

Listening - dialogues & conversations - **Speaking** – role plays – asking about routine actions and expressing opinions - **Reading** longer texts & making a critical analysis of the given text - **Writing** – types of paragraph and writing essays – rearrangement of jumbled sentences - writing recommendations - **Language Development** – use of sequence words - cause & effect expressions - sentences expressing purpose - picture based and newspaper based activities – single word substitutes

UNIT IV VOCABULARY BUILDING AND WRITING SKILLS

9

Listening - debates and discussions – practicing multiple tasks – self introduction – **Speaking** about friends/places/hobbies - **Reading** - Making inference from the reading passage – Predicting the content of the reading passage - **Writing** – informal letters/e-mails - **Language Development** - synonyms & antonyms - conditionals – if, unless, in case, when and others – framing questions.

UNIT V LANGUAGE DEVELOPMENT AND TECHNICAL WRITING

9

Listening - popular speeches and presentations - **Speaking** - impromptu speeches & debates - **Reading** - articles – magazines/newspapers **Writing** – essay writing on technical topics - channel conversion – bar diagram/ graph –

picture interpretation - process description - **Language Development** – modal verbs - fixed / semi-fixed expressions – collocations

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al. Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. <http://engineeringvideolectures.com/course/696>

ONLINE RESOURCES:

1. <https://www.pearson.com/english/catalogue/business-english/technical-english.html>
2. <https://www.cambridgeenglish.org/learning-english/free-resources/>

OUTCOMES:

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

1. Comprehend conversations and talks presented in English (K2)
2. Speak fluently in informal and formal contexts (K1)
3. Read articles of any kind and be able to comprehend (K2)
4. Write technical concepts in simple and lucid style (K2)
5. Prepare informal letters and e-mails efficiently (K3)
6. Present technical concepts and summaries in correct grammar and vocabulary (K1)

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	1	-	-	3	-	-
CO2	1	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	-	-	-	-	3	2
CO4	-	3	-	-	-	-	-	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-
CO6	-	-	-	-	-	-	3	-	-	-	2	-

SEMESTER - I

20BSPH101 SDG NO. 4	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To educate and enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

UNIT I CRYSTAL PHYSICS**9**

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - Powder diffraction method - Debye Scherer formula - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy - Diamond and Graphite structure (qualitative) - Growth of single crystals: Solution and Melt growth Techniques.

UNIT II PROPERTIES OF MATTER**9**

Elasticity - Stress - strain diagram and its uses - Poisson's ratio - Relationship between three moduli of elasticity (qualitative) - Factors affecting elastic modulus and tensile strength - Twisting couple - shaft - Torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT III QUANTUM PHYSICS**9**

Black body radiation - Planck's theory (derivation) - Compton effect: theory -

wave particle duality - electron diffraction - progressive waves - wave equation - concept of wave function and its physical significance - Schrödinger's wave equation - Time independent and Time dependent equations - particle in a box (one dimensional motion) - Tunneling (qualitative) - scanning tunneling microscope.

UNIT IV LASERS AND FIBER OPTICS

9

Lasers: population of energy levels, Einstein's A and B coefficients derivation - pumping methods - resonant cavity, optical amplification (qualitative) - three level and four level laser - CO₂ laser - Semiconductor lasers: Homojunction and Heterojunction.

Fiber optics: Principle, Numerical aperture and Acceptance angle - Types of optical fibers (material, refractive index, mode) - Losses associated with optical fibers - Fiber Optical Communication system (Block diagram) - Fiber optic sensors: pressure and displacement.

UNIT V THERMAL PHYSICS

9

Transfer of heat energy - thermal expansion of solids and liquids - bimetallic strips - thermal conduction, convection and radiation - heat conduction in solids (qualitative) - thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) - thermal insulation - applications: heat exchangers, refrigerators and solar water heaters.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattachary & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur & S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu & P.G. Kshirshagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, . Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma, "Physics for Engineers", PHI Learning Private Limited, 2014.

- P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
- Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
- Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

OUTCOMES:

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

- Understand the basics of crystals, structures and crystal growth techniques (K3)
- Select a right choice of materials based on their properties for potential applications / acquire fundamental knowledge on elasticity and its applications relevant to the field of engineering (K3)
- Apply the advanced physics concepts of quantum theory to characterize the matter (K4)
- Understand the basic concepts in laser and its types and fiber optics (K3)
- Acquire adequate knowledge on the fundamental concepts of thermal properties of materials (K2)
- Evaluate the applications of powder diffraction method, optical fibers in sensors, quantum mechanical tunneling and thermal materials in expansion joints and heat exchangers (K4)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	-	-	-	-	-	-	-	1
CO2	3	2	3	3	-	-	2	-	-	-	-	3
CO3	3	3	3	2	-	-	3	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3
CO5	3	3	3	3	-	-	3	-	-	-	-	3
CO6	3	3	3	3	-	-	3	-	-	-	-	3

SEMESTER - I

20BSCY101 SDG NO. 4,6&7	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques
- To illustrate the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials
- To categorize types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels
- To demonstrate the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills and fuel cells
- To recognize the applications of polymers, composites and nano-materials in various fields

UNIT I WATER TECHNOLOGY AND SURFACE CHEMISTRY 9

Water Technology : Introduction – Hard water and Soft water. Hardness of water – types – expression of hardness (numerical problems). Boiler troubles – scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion. Treatment of boiler feed water – Internal treatment (carbonate, phosphate, calgon, colloidal and sodium aluminate conditioning). External treatment – Ion exchange process, Zeolite process – Domestic water treatment (break point chlorination) – Desalination of brackish water – Reverse Osmosis.

Surface Chemistry: Adsorption – types – adsorption of gases on solids – adsorption of solutes from solution – applications of adsorption – role of adsorbents in catalysis and pollution abatement.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Cells – types (electrochemical and electrolytic cell) Redox reaction – single electrode potential (oxidation potential and reduction potential) – measurement and applications – Nernst equation (derivation and problems) – electrochemical series and its significance.

Corrosion: Causes, factors and types – chemical and electrochemical corrosion (galvanic, differential aeration). Corrosion control – material selection and design aspects, cathodic protection methods (sacrificial anodic and impressed current cathodic method) and corrosion inhibitors. Paints: Constituents and its functions. Electroplating of Copper and electroless plating of Nickel.

UNIT III FUELS AND COMBUSTION**9**

Fuels: Introduction – classification of fuels – Coal – analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – octane number and cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gases (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of Fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – flue gas analysis (ORSAT Method).

UNIT IV ENERGY SOURCES AND STORAGE DEVICES**9**

Energy sources: Nuclear fission – nuclear fusion – differences between nuclear fission and fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Storage devices: Batteries – types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery), fuel cells – H₂ -O₂ fuel cell and super capacitors.

UNIT V POLYMERS AND NANOMATERIALS**9**

Polymers: Classification – types of polymerization – mechanism (Free radical polymerization) –Engineering polymers: Nylon-6, Nylon-6,6, Teflon, Kevlar and PEEK – preparation, properties and uses – Plastic and its types – Conducting polymers – types and applications. Composites – definition, types, polymer matrix composites – FRP.

Nanomaterials: Introduction – Nanoparticles, Nanoclusters, Nanorods, Nanotubes (CNT: SWNT and MWNT) and Nanowires – Properties (surface to volume ratio, melting point, optical and electrical), Synthesis (precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process) and Applications.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

OUTCOMES**Upon completion of the course, the student should be able to**

1. Identify the origin of water resources and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost. (K2)
2. Recognize the basic design of adsorption systems and its industrial applications and the basic concepts of electrochemistry to understand battery technology. (K2)
3. Apply the principles of electrochemistry to corrosion process and the applications of protective coatings to overcome the corrosion. (K3)
4. Disseminating the knowledge about the chemistry of fuels and combustion and its application in various levels. (K2)
5. Acquire the basics of non-conventional sources of energy and understand the principles and the reaction mechanism of batteries and fuel cells.. (K3)
6. Illustrate the synthesis and applications of polymers, composites and nano-materials. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	-	-	1	2	-	-	-	-	1
CO2	3	2	2	2	1	1	2	-	-	-	-	3
CO3	3	2	3	2	1	1	2	-	-	-	1	1
CO4	3	1	2	2	-	1	2	-	-	-	1	1
CO5	3	2	3	1	1	1	2	-	-	-	1	3
CO6	3	2	3	1	-	1	1	-	-	-	1	2

SEMESTER - I

20ESCS101 SDG NO. 4&9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about the programming language
- To develop C Programs using basic Programming Constructs, Loops Arrays and Strings
- To develop applications in C using Functions , Pointers and Structures
- To perform I/O operations and File Handling in C

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING

10

The Basic Model of Computation, Programming Paradigms- Program Development Life Cycle - Algorithm –Pseudo Code – Flow Chart - Programming Languages - Compilation - Linking and Loading - Testing and Debugging - Documentation - Control Structures – Algorithmic Problem Solving- Problems Based on Sequential, Decision Making - Branching and Iteration.

UNIT II BASICS OF C PROGRAMMING

8

Structure of C program - C programming: Data Types – 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

UNIT III 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 – Selection Sort - Linear and Binary Search.

UNIT IV FUNCTIONS AND POINTERS

9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –

Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

UNIT V STRUCTURES and FILE PROCESSING

9

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie, D.M, “The C Programming language”, Second Edition, Pearson Education, 2012.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “C How to Program”, Seventh edition, Pearson Publication.
2. Jeri R. Hanly & Elliot B. Koffman, “Problem Solving and Program Design in C”, Pearson Education, 2013.
3. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Kanetkar Y, “Let us C”, BPB Publications, 2007.
7. Hanly J R & Koffman E.B, “Problem Solving and Programme design in C”, Pearson Education, 2009.

WEB REFERENCES:

1. <https://www.learn-c.org/>
2. <https://codeforwin.org/>
3. <https://www.cprogramming.com/>

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial
2. <https://nptel.ac.in/courses/106105171>
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:

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

1. Develop efficient algorithms for solving a problem. (K2)
2. Use the various constructs in C to develop simple applications. (K3)
3. Design and Implement applications using Array & Strings. (K3)
4. Develop applications using Functions and Pointers. (K6)
5. Design and Develop applications using Structures. (K3)
6. Design and Develop applications using Files. (K4)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	3	3	3	3	2	1	1	-	2	2	-	3	2	3
C02	3	3	3	3	2	-	1	1	2	2	3	3	2	3
C03	3	3	3	3	2	1	1	1	2	-	3	-	3	2
C04	3	3	3	3	2	1	-	1	2	2	3	3	1	2
C05	3	3	3	3	2	1	1	1	2	2	3	3	2	1
C06	3	3	3	3	2	1	1	1	2	2	3	3	3	2

SEMESTER - I

20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15	ENGINEERING GRAPHICS				L	T	P	C
					1	2	0	3

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products
- To visualize the job in three dimensions
- To have a clear conception and appreciation of the shape, size, proportion and design
- To expose the student community to existing national standards related to technical drawings

CONCEPTS AND CONVENTIONS (Not for Examination)**3**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Projection of Points

UNIT I PLANE CURVES AND FREEHAND SKETCHING**6+9**

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – construction of involutes of circle for one complete revolution – Drawing of tangents and normal to the above curves.

Visualization concepts and Free Hand sketching: Visualization principles –Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF LINES AND PLANE SURFACE**6+9**

Orthographic projection- principles-Principal planes- Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method-Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS**6+9**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES**6+9**

Sectioning of prisms, pyramids, cylinder and cone in simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and truncated solids in vertical position – Prisms, pyramids cylinder and cone.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS**6+9**

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone- Perspective projection of simple solids-Prisms, pyramids and cylinder by visual ray method.

TOTAL: 78 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. T. Jeyapooan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt.Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
7. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/112/103/112103019/>

ONLINE RESOURCES:

1. <https://nptel.ac.in/courses/105/104/105104148/>

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

OUTCOMES:

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

1. Relate thoughts and ideas graphically in a neat fashion and ability to perform sketching of engineering curves used in engineering practices, multiple views of objects. (K1)
2. Understand the concepts of orthographic projections for basic geometrical constructions. (K2)
3. Acquire the knowledge of orthographic projection in three dimensional object. (K2)
4. Develop knowledge about Sectioning and apply interior shapes of solids. (K3)
5. Analyze the concepts of design in developing various 3 dimensional projections. (K4)
6. Build a strong foundation to analyze the design in various dimensions. (K4)

CO - PO , PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C02	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C03	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C04	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C05	3	2	2	-	-	-	-	-	2	2	-	2	2	2
C06	3	2	2	-	-	-	-	-	2	2	-	2	2	2

SEMESTER - I

20BSPL101 SDG NO. 4	PHYSICS AND CHEMISTRY LABORATORY			
	L	T	P	C
	0	0	3	1.5

PHYSICS LABORATORY**OBJECTIVES:**

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics and properties of matter for developing basic experimental skills
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of Young's modulus by non-uniform bending method.
2. Determination of rigidity modulus –Torsion pendulum.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. (a) Determination of wavelength and particle size using Laser.
(b) Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's bridge.
7. Determination of wavelength of mercury spectrum – spectrometer grating.
8. Determination of band gap of a semiconductor.
9. Determination of Hall coefficient by Hall Effect experiment.
10. Determination of solar cell characteristics.

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS /
6 (max.) STUDENTS PER EXPERIMENT**

- | | |
|--|-----------|
| 1. Young's modulus by non-uniform bending method-
experimental set-up | – 12 sets |
| 2. Rigidity modulus - Torsion pendulum experimental
set-up | – 12 sets |
| 3. Ultrasonic Interferometer to determine velocity of sound
and compressibility of liquid | – 6 sets |
| 4. (a) Experimental set-up to find the wavelength of light,
and to find particle size using Laser | – 6 sets |
| (b) Experimental set-up to find acceptance angle in an
optical fiber | – 6 sets |
| 5. Lee's disc method- experimental set up to find thermal
conductivity of a bad conductor | – 6 sets |
| 6. Experimental set-up to find specific resistance of a coil
of wire-Carey Foster's Bridge | – 6 sets |
| 7. Experimental set-up to find the wavelength of mercury
spectrum-spectrometer grating | – 6 sets |
| 8. Experimental set-up to find the band gap of a semiconductor | – 12 sets |
| 9. Experimental set-up to find the Hall coefficient by
Hall Effect Experiment | – 6 sets |
| 10. Experimental set-up to study characteristics of solar cells | – 6 sets |

TEXTBOOKS:

1. J.D. Wilson & C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.
2. M.N. Srinivasan, S. Balasubramanian & R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

CHEMISTRY LABORATORY**(Any five experiments to be conducted)****OBJECTIVES:**

- To acquaint the students with practical knowledge of the basic concepts of chemistry, the student faces during the course of their study in the industry and engineering field
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To understand and develop experimental skills for building technical competence

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
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. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
9. Estimation of sodium and potassium present in water using flame photometers.
10. Determination of molecular weights of polymers using Ostwald's Viscometer.

**LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS /
6 (MAX.) STUDENTS PER EXPERIMENT.**

- | | |
|---|----------|
| 1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample | - 6 sets |
| 2. Determination of total, temporary & permanent hardness of water by EDTA method | - 6 sets |
| 3. Determination of DO content of water sample by Winkler's method | - 6sets |
| 4. Determination of chloride content of water sample by argentometric method | - 6 sets |
| 5. Determination of strength of given hydrochloric acid using pH meter | - 6 sets |
| 6. Conductometric titration of strong acid vs strong base | - 6 sets |
| 7. Estimation of iron content of the given solution using potentiometer | - 6 sets |
| 8. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method) | - 2 sets |
| 9. Estimation of sodium and potassium present in water using flame photometer | - 2 sets |
| 10. Determination of molecular weights of polymer using Ostwald's Viscometer. | - 6 sets |

TOTAL: 30 PERIODS

TEXTBOOKS:

- Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

OUTCOMES:

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

- Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer. (K1)
- Understand measurement technique and usage of new instruments in optics for real time application in engineering. (K2)
- Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for engineering solutions. (K3)
- Apply the different techniques of quantitative chemical analysis to generate experimental skills in building technical competence. (K2)
- Apply basic techniques used in chemistry laboratories for water

analyses/purification and estimates the ions/metal ions present in domestic/industry wastewater. (K2)

6. Utilize the fundamental laboratory techniques for analyses such as volumetric titrations, conductometric, potentiometric and spectroscopy. (K2)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	3	3	2	2	1	1	3
CO2	3	3	3	3	3	3	3	2	2	2	2	3
CO3	3	3	3	3	3	3	3	2	1	1	2	3
CO4	3	2	3	3	1	1	2	2	2	2	3	2
CO5	3	2	3	3	1	1	2	2	2	2	3	2
CO6	3	2	3	3	1	1	2	2	2	2	3	2

SEMESTER - I

20ESPL101 SDG NO. 4&9	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop programs in C using basic Programming Constructs
- To develop applications in C using Arrays and Strings
- To design and implement applications in C using Functions, Structures
- To develop applications in C using Files

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.

5. Write a program to check whether a given number is Armstrong number or not?
6. Write a program to check whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.
13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
 - (a) Total marks obtained by each student.
 - (b) The highest marks in each subject and the marks of the student who secured it.
 - (c) The student who obtained the highest total marks.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler

30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

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

1. Solve some simple problems leading to specific applications. (K3)
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program. (K3)
3. Develop C programs for simple applications making use of basic constructs, arrays and strings. (K4)

4. Develop C programs involving functions and recursion. (K4)
5. Develop C programs involving pointers, and structures. (K6)
6. Design applications using sequential and random access file. (K4)

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	1	2	2	3	3	2	3
CO2	3	3	3	3	2	1	-	1	2	2	3	3	1	3
CO3	3	3	-	3	2	-	1	1	-	2	-	3	3	2
CO4	3	3	3	3	2	1	1	1	2	2	3	3	1	3
CO5	3	3	3	-	2	-	1	-	2	2	3	-	2	1
CO6	3	3	3	3	2	1	1	1	2	-	3	3	3	2

SEMESTER - I

20TPHS101 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES**6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp, Telegram, Youtube, Evolution of Android and IOS, Introduction to LinkedIn & Benefits. (Practicals – Official Mail id- LinkedIn Id Creation, LinkedIn Profile Building, Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE**6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN -DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode- VPN – Pros and Cons – Book mark.

UNIT III NETWORKING**6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online compiler and editor (Practicals – Find Your System IP, Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM**6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION**6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking, Register for payment gateway).

TOTAL : 30 PERIODS**WEB REFERENCES :****Unit I: Social Network Etiquettes:**

1. <https://sproutsocial.com/glossary/social-media-etiquette/>
2. <https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx>
3. <https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full>
4. <https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79>
5. <https://buffer.com/library/how-to-use-instagram/>
6. <https://www.webwise.ie/parents/what-is-youtube/>
7. <https://www.androidauthority.com/history-android-os-name-789433/>
8. <https://www.mindtools.com/pages/article/linkedin.htm>

Unit II: Browsing Culture:

1. <https://sites.google.com/site/bethanycollegeofteacheredn/unit--ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web>
2. <https://www.wordstream.com/articles/internet-search-engines-history>
3. <https://www.malwarebytes.com/phishing/>
4. <https://www.adpushup.com/blog/types-of-cookies/>

5. <https://www.eff.org/https-everywhere>
6. <https://www.sciencedirect.com/topics/computer-science/browsing-history>
7. <https://www.vpnmentor.com/blog/pros-cons-vpn/>
8. <https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html>

Unit III: Networking

1. <https://www.guru99.com/types-of-computer-network.html>
2. <https://www.studytonight.com/computer-networks/network-topology-types>
3. <https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/>
4. <https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/>
5. <https://paiza.io/en>

Unit IV : Professionalism

1. <https://career.vt.edu/develop/professionalism.html>
2. <https://englishlabs.in/importance-dress-code/>
3. <https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life>
4. <https://www.thespruce.com/etiquette-of-proper-attire-1216800>
5. <https://shirleytaylor.com/why-are-communication-skills-important/>
6. <https://www.triad-eng.com/interview-tips-for-engineers/>
7. <https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself>
8. <https://toggl.com/track/business-etiquette-rules/>

Unit V: Digital Identification

1. <https://nad.ndml.in/nad-presentation.html>
2. <https://www.turtlemint.com/aadhaar-card-benefits/>
3. <https://www.bankbazaar.com/pan-card/uses-of-pan-card.html>
4. <https://www.passportindex.org/passport.php>
5. <https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account>
6. https://en.wikipedia.org/wiki/QR_code

7. <https://www.investopedia.com/terms/p/payment-gateway.asp>
8. <https://www.paisabazaar.com/banking/mobile-banking/>

OUTCOMES:

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

1. Learn and apply social network ethics. (K3)
2. Understand the browsing culture. (K2)
3. Analyze the networking concepts. (K4)
4. Develop self professionalism. (K3)
5. Gain hands-on experience in various digital identification procedures. (K2)
6. Analyse and apply the different digital payment gateway methods. (K4)

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - I

20HSMG101 SDG NO. 4&5	PERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT**6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES**6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES**6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING**6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING**6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS**Note:**

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

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

1. Become an individual in knowing the self. (K4)
2. Acquire and express Personal Values, Spiritual values and fitness. (K4)
3. Practice simple physical exercise and breathing techniques. (K2)
4. Practice Yoga asana which will enhance the quality of life. (K1)
5. Practice Meditation and get benefitted. (K1)
6. Understanding moral values and need of physical fitness. (K2)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
Co1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

20BSMA201 SDG NO. 4	ENGINEERING MATHEMATICS - II	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques in Vector Calculus, Ordinary differential equations, Complex variables and Laplace transforms. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT I VECTOR CALCULUS 12

Gradient and Directional derivatives - Divergence and Curl- Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Volume integral – Gauss divergence, Green's and Stoke's theorems - Verification and application in evaluating line, Surface and volume integrals.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 12

Second and higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogeneous equation of Euler's and Legendre's types - System of simultaneous linear differential equations with constant coefficients.

UNIT III COMPLEX DIFFERENTIATION 12

Analytic functions- Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof) - Properties - Harmonic conjugate - construction of analytic functions- Conformal mapping - Mapping by functions $w = z+a, w=az, w=1/z, w=z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Contour integrals, Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof) – Application of Residue theorem for evaluation of real integrals – use of circular contour and semicircular contour (without poles on real axis).

UNIT V LAPLACE TRANSFORM 12

Existence conditions – Transforms of elementary functions – Transform of Unit step function and Unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and Final value

theorems – Convolution theorem – Transform of Periodic functions – Application of solution of linear second order ordinary differential equations with constant coefficients.

TEXT BOOKS:

1. Ramana.B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. Erwin Kresizg, “Advance Engineering Mathematics”, 9th Edition, John Wiley & Sons, 2006.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, “Higher Engineering Mathematics”, S.Chand Private Ltd., 2011.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2010.
3. Peter V.O’Neil, “Advanced Engineering Mathematics”, 7th Edition, Cengage learning, 2012.
4. E.A.Coddinton, “An Introduction to Ordinary Differential Equations”, Prentice Hall India, 1995.
5. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 40th Edition, 2014.
6. N.P.Bali and Manish Goyal, “A text Book of Engineering Mathematics”, Laxmi Publications, Reprint 2008.

WEB COURSES:

1. <https://nptel.ac.in/courses/122107036/>
2. <https://nptel.ac.in/courses/111105134/>
3. <https://ocw.mit.edu/courses/mathematics/18-04-complex-variables-with-applications-spring-2018/>
4. <https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/>
5. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>

ONLINE RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/>
2. <http://www.nptelvideos.com/course.php?id=90>

COURSE OUTCOMES:

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

1. Compute the derivatives of scalar point, vector point functions and evaluate line, surface and volume integrals of vector point functions using Stokes, Greens, and Gauss divergence theorems. (K3)
2. Solve Ordinary differential equations of second and higher order with constant coefficients, variable coefficients and simultaneous linear differential equations. (K3)
3. Construct an analytic function and find the harmonic conjugate, apply the properties of analytic functions to check for harmonic and orthogonal functions and find the images of regions, straight lines and points in the Z-plane under the mappings

$$w = z + a, w = az, w = \frac{1}{z}, w = z^2 \text{ and bilinear transformation. (K3)}$$

4. Find the Taylor's series about a point and Laurent's series in an annular region of analytic functions and Evaluate integrals of analytic functions and real integrals over circular and semicircular contour using Cauchy Goursat theorem, Cauchy integral formula and Cauchy Residue theorem. (K3)
5. Find the Laplace transforms of simple and periodic functions by applying the definition and theorems on Laplace transforms. (K3)
6. Determine the Inverse Laplace transform using the theorems, the method of partial fractions, Convolution and solve linear second order ordinary differential equations with constant coefficients using Laplace transforms. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1
CO6	3	3	2	1	-	-	-	-	-	-	-	1

SEMESTER - II

20HSEN201 SDG NO. 4	TECHNICAL ENGLISH - II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To strengthen the listening skills for comprehending and critically analyzing passages
- To enhance students' ability with multiple strategies and skills for making technical presentations
- To participate in group discussions for developing group attitude
- To develop skills for preparing effective job application
- To write effective technical reports

UNIT I LANGUAGE DEVELOPMENT 9

Listening – Listening conversations involving two participants – multiple participants – **Speaking** – conversation methods in real life occurrences using expressions of different emotions and imperative usages – **Reading** passages and short stories - **Writing** – preparation of checklist – extended definition – **Language Development** – tenses - subject - verb agreement

UNIT II VOCABULARY BUILDING 9

Listening – listening formal and informal conversation and participative exercises – **Speaking** - creating greetings/wishes/excuses and thanks – **Reading** – articles/novels-**Writing** summary of articles and concise writing identifying new words – homonyms, homophones, homographs – one-word substitutions – easily confused words - creating SMS and using emoticons - sharing information in social media. **Language Development** - reported speeches – regular and irregular verbs - idioms & phrases

UNIT III WRITING TECHNICAL REPORTS 9

Listening – listening conversation – effective use of words and their sound aspects, stress, intonation & pronunciation – **Speaking** - practicing telephonic conversations – observing and responding. **Reading** – regular columns of newspapers/magazines - **Writing** – reports – feasibility, accident, survey and progress - preparation of agenda and minutes – **Language Development** - using connectives – discourse markers

UNIT IV TECHNICAL WRITING 9

Listening – Model debates & documentaries - **Speaking** – expressing agreement/disagreement, assertiveness in expressing opinions – **Reading**

biographies/autobiographies – **Writing** – note-making – formal letters – inviting guests – acceptance/declining letters - **Language Development** – degrees of comparison - numerical adjectives – embedded sentences

UNIT V GROUP DISCUSSION AND JOB APPLICATION

9

Listening – Listening - classroom lectures – recommending suggestions & solutions – **Speaking** – participating in group discussion – learning GD strategies – **Reading** – journal articles - Writing – Job application – cover letter - résumé preparation – **Language Development** – purpose statement – editing – verbal analogies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of editors. Fluency in English: A Course book for Engineering and Technology. Orient Blackswan, Hyderabad 2016.
2. Ashraf Rizvi. M, Effective Technical Communication. 2nd ed. McGraw Hill, New Delhi, 2018.

REFERENCES

1. Bailey, Stephen. Academic Writing: A Practical Guide for Students. Routledge, New York, 2011.
2. Raman, Meenakshi and Sharma, Sangeetha. Technical Communication Principles and Practice. Oxford University Press, New Delhi, 2014.
3. Muralikrishnan & Mishra Sunitha, Communication skills for Engineers 2nd ed. Pearson, Tamilnadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Suresh Kumar, E. Engineering English. Orient Blackswan, Hyderabad, 2015
5. Richards, Jack C. Interchange Students' Book – 2. Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. <https://freevideolectures.com/course/3250/introduction-to-film-studies/10>

ONLINE RESOURCES

1. <https://www.ef.com/wwen/english-resources/>

2. https://www.smilesforlearning.org/gclid=EAlaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAYASAAEgIBPvD_BwE.

OUTCOMES:

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

1. Acquire the ability to speak effectively in real life situations (K1)
2. Adapt group behaviour and execute the role as a contributing team member (K1)
3. Employ active and passive vocabulary in oral and written communication (K2)
4. Share opinions and suggestions effectively in conversations, debates and discussions (K2)
5. Prepare winning job applications (K3)
6. Write technical reports convincingly (K3)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	-	-	-	-	3	-	2
C02	-	2	-	-	-	-	-	-	-	3	-	-
C03	-	-	-	1	-	-	2	-	-	3	-	-
C04	-	-	-	-	-	2	-	3	-	-	-	-
C05	-	-	-	-	-	-	-	-	-	3	-	2
C06	-	-	-	-	-	-	-	-	-	3	-	2

SEMESTER - II

20ESIT201 SDG NO. 4	PYTHON PROGRAMMING WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To Develop Python Programs with Conditionals and Loops
- To Use Python Data Structures – Lists, Tuples, Dictionaries, Sets
- To Define Python Functions and Work with Modules and Packages
- To Work with Python Classes, Objects and Handling Exceptions

UNIT I BASICS OF PYTHON PROGRAMMING**9**

Python Interpreter and Interactive Mode - Features – History of Python – Literals – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Operator Precedence– Operations on Strings – Other Data types – Type Conversion - Illustrative Programs: Use of various Operators, Evaluation of expressions, String Operations.

UNIT II DECISION CONTROL STATEMENTS**9**

Conditionals: Boolean Values and Operators, Conditional (if) - Alternative (if-else) - Chained Conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Illustrative Programs: Exchange the Values of Two Variables - Circulate the values of N Variables - Distance Between Two Points - Square Root - GCD - Exponentiation - Sum and Array of Numbers.

UNIT III STRING, LISTS, TUPLES, DICTIONARIES, SETS**9**

Strings: String Slices - Immutability - String functions and methods - String Module - 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 - Sets: Creating Sets – Operations and Methods – Set Comprehension - Illustrative programs: Linear Search - Binary Search - Selection Sort - Insertion Sort - Merge Sort - Histogram.

UNIT IV FUNCTIONS, MODULES AND PACKAGES**9**

Functions - Function Definition and Use - Flow of Execution - Parameters and Arguments - Fruitful Functions: Return values - Parameters - Local and Global Scope - Function Composition - Recursion - Modules – from-import Statement – Name of Module – Making your own modules - Packages - Standard Library Modules – globals(), locals() and reload() - Illustrative programs: Fibonacci Series using functions - Arithmetic Operations using Module - Area of different shapes using Packages.

UNIT V CLASSES, OBJECTS AND EXCEPTION HANDLING**9**

Classes and Objects – Defining Classes – Creating Objects – Data Abstraction and Hiding through Classes - init() method – Class Variables and Object Variables – Introduction to Errors and Exception Handling – Handling Exceptions – Multiple Except Blocks – else Clause – Raising Exceptions – Built-in and User-defined Exceptions – Finally Block.

LIST OF EXPERIMENTS

1. Write a Python program to perform
 - a. Linear Search
 - b. Binary Search
2. Write a Python program to perform Selection Sort.
3. Write a Python program to sort the given numbers using Insertion Sort.
4. Write a Python program to do sorting using Merge sort.
5. Write a Python program to find first n prime numbers.
6. Write a Python program to Multiply two matrices.
7. Write a Python program to create Student class and instantiate its Object.
8. Write a Python License verification process using Exception handling.

TOTAL: 60 PERIODS**TEXT BOOKS:**

1. ReemaThareja. "Python Programming Using Problem Solving Approach", Oxford University Press 2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, O'Reilly Publishers, 2016.

REFERENCES:

1. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press, 2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
7. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

1. <http://greenteapress.com/wp/think-python/>
2. www.docs.python.org
3. <https://nptel.ac.in/courses/106/106/106106182/>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Describe the syntax, semantics and control flow statements of Python programming. (K2)
2. Implement simple programs using control structures in Python. (K3)
3. Explain the methods to create and manipulate strings, lists, dictionaries, tuples and sets. (K2)
4. Articulate the concepts of functions, modules and packages in Python. (K2)
5. Implement simple programs using Python Data types and functions. (K3)
6. Apply the concepts of Exception handling, classes and objects. (K3)

CO - PO, MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	1	2	-	-	-	1	-	3	3
CO2	1	2	3	3	3	2	1	1	1	1	1	3
CO3	-	1	3	3	2	1	-	-	-	-	1	3
CO4	1	2	3	3	2	-	-	-	-	-	1	3
CO5	2	3	3	3	3	1	1	2	2	1	2	3
CO6	2	3	3	3	3	1	1	2	2	1	2	3

SEMESTER - II

20BSPH201 SDG NO. 4	PHYSICS OF ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquaint the electrical properties of materials.
- To present the principles of semiconductor physics and its applications.
- To educate the properties of magnetic and dielectric materials and their uses.
- To introduce the bipolar junction transistors.
- To explicit the field effect transistors, power and display devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS**9**

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures -

electrons in metals - Particle in a three dimensional box - degenerate states - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential- Energy bands in solids - Tight binding approximation - Electron effective mass- concept of hole.

UNIT II SEMICONDUCTOR DIODES 9

Semiconductors - Intrinsic, Extrinsic semiconductor, Carrier concentration, PN junction diode- Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Special purpose diodes - Schottky barrier diode, Zener diode, Varactor diode, Tunnel diode, LASER diode and LDR.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials - magnetic field and induction - magnetization - magnetic permeability and susceptibility - types of magnetic materials - microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction - saturation magnetization and Curie temperature - Domain Theory - Hysteresis phenomenon - Ferrites. Dielectric materials: Polarization processes - dielectric loss - internal field - Clausius-Mosotti relation - dielectric breakdown.

UNIT IV BIPOLAR JUNCTION TRANSISTOR 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid - π model - h-parameter model, Ebers Moll Model- Gummel Poon- model, Multi Emitter Transistor.

UNIT V FIELD EFFECT TRANSISTORS, POWER AND DISPLAY DEVICES 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage - Channel length modulation, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET. Power Devices-UJT, SCR, Diac, Triac, Display Devices-LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald A Neaman, "Semi-conductor Physics and Devices", Fourth Edition, TataMcGrawHill Inc.2012.
2. Salivahanan.S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill,2008.

REFERENCES:

1. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, "A Text Book of Applied Electronics" S.Chand Publications, 2006.
3. Yang, "Fundamentals of Semiconductor Devices", McGraw Hill International Edition, 1978.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Understand the electrical properties of materials. (K1)
2. Analyze the principles of semiconductor physics and its applications. (K2)
3. Explore the properties of magnetic and dielectric materials and their uses. (K2)
4. Understand the theory, construction and operation of the bipolar junction transistors. (K3)
5. Analyse the concept of field effect transistors, power and display devices (K2)
6. Learn the concepts of Physics towards engineering applications. (K1)

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	1	1	-	3	-	-	1	2	-
CO2	3	2	3	2	3	1	1	-	1	1	-	1	3	-
CO3	3	2	3	3	3	1	1	-	1	-	-	1	3	-
CO4	1	1	3	1	-	-	1	-	2	-	-	-	2	-
CO5	2	2	1	2	3	-	1	-	2	-	-	1	2	-
CO6	3	3	2	1	2	2	1	-	2	-	-	1	2	-

SEMESTER - II

20ECPC201 SDG NO. 4, 9	CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of DC and AC circuits behavior.
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 9

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology – Graph of a network - Incidence and reduced incidence matrices – Trees –Cutsets - Fundamental cut sets – Cutset matrix – Tiesets - Link currents and Tieset schedules -Twig voltages and Cutset schedules, Duality and dual networks.

UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem, Application of Network theorems - Network reduction: voltage and current division, source transformation – star delta conversion.

UNIT III RESONANCE AND COUPLED CIRCUITS 9

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency -Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor -Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multi-winding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

UNIT IV TRANSIENT ANALYSIS 9

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

UNIT V TWO PORT NETWORKS 9

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks,

Symmetrical properties of T and π networks.

TOTAL PERIODS :45

TEXT BOOKS:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, 8th Edition, 11th Reprint, 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, 5th Edition Reprint 2016.

REFERENCES:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 9th Reprint, 2015.
2. A. Bruce Carlson, "Circuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition, 2nd Indian Reprint, 2009.
3. Allan H. Robbins, Wilhelm C. Miller, "Circuit Analysis Theory and Practice", Cengage Learning, 5th Edition, 1st Indian Reprint, 2013.
4. Euo F.F., "Network Analysis and Synthesis", Wiley International Edition, 2nd Edition, 1996.
5. Sudhakar and Shyammohan, "Network Analysis & Synthesis".

WEB RESOURCES:

1. <https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic>
2. <http://homepages.wmich.edu/~miller/ECE2100.html>
3. <https://engineering.purdue.edu/~ee202><https://engineering.purdue.edu/~ee202>

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc17_ee13/preview
2. <https://www.coursera.org/learn/linear-circuits-dcanalysis>
3. https://onlinecourses.nptel.ac.in/noc17_ee15/preview
4. <https://swayam.gov.in/course/218-networks-and-systems>

OUTCOMES:

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

1. Define the basic laws and apply the methods for analyzing electrical circuits. (K3)

2. Recall the basic concepts of graph theory and analyze the electric circuits using graph theory. (K4)
3. Analyze dc and ac electric circuits using theorems. (K4)
4. Test and evaluate circuits based on the knowledge gained to explain the behavior of the circuit at series and parallel resonance and the effect of resonance. (K4)
5. Describe the response of RL, RC and RLC circuits for standard test signals like step and sinusoidal signals. (K2)
6. Implement two port equivalents for electric circuits. (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	3	-	2	-	-	-	-	-	2	3	2
C02	3	2	2	2	-	-	-	-	-	-	-	2	3	2
C03	3	3	2	2	-	-	-	-	-	-	-	2	3	2
C04	3	3	2	3	-	2	-	-	-	-	-	2	3	2
C05	3	3	2	3	-	2	-	-	-	-	-	2	3	2
C06	3	3	2	2	-	-	-	-	-	-	-	2	3	2

SEMESTER - II

20ESGE201 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering

ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring.
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.

5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of electrical equipment.

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor; colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.
3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Machine assembly practice:

1. Study of centrifugal pump.
2. Study of air conditioner.

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending.
Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

Total : 45 PERIODS**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS****1. Electrical**

1	Assorted electrical components for house wiring	15 Sets
2	Electrical measuring instruments	10 Sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 Each
4	Megger (250V/500V)	1 No
5	Power Tools: Range Finder Digital Live-wire detector	2 Nos 2 Nos

2. Electronics

1	Soldering guns	10 Nos
2	Assorted electronic components for making circuits	50 Nos
3	Small PCBs	10 Nos
4	Multimeters	10 Nos

3. Civil

1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
---	--	---------

2	Carpentry vice (fitted to work bench)	15 Nos
3	Standard woodworking tools	15 Sets
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools:	
	Rotary Hammer	2 Nos
	Demolition Hammer	2 Nos
	Circular Saw	2 Nos
	Planer	2 Nos
	Hand Drilling Machine	2 Nos
	Jigsaw	2 Nos

4. Mechanical

1	Arc welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	5 Nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc	5 Sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos
5	Centre lathe	2 Nos
6	Hearth furnace, anvil and smithy tools	2 Sets
7	Moulding table, foundry tools	2 Sets
8	Power Tool: Angle Grinder	2 Nos
9	Study-purpose items: centrifugal pump, air-conditioner	1 each

OUTCOMES:

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

1. Elaborate on the components, gates, soldering practices. Calculate electrical parameters such as voltage, current, resistance and power. (K1)
2. Design and implement Rectifier and Timer circuits (K2)
3. Measure the electrical energy by single phase and three phase energy meters. (K2)
4. Prepare the carpentry and plumbing joints. (K2)
5. Perform different types of welding joints and sheet metal works (K2)
6. Perform different machining operations in lathe and drilling. (K2)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	2	1	-	-	1	1	1	1
CO2	3	2	1	1	2	1	-	-	1	1	1	1
CO3	2	2	1	1	1	1	-	-	1	1	1	1
CO4	1	1	1	-	-	2	-	-	1	1	1	2
CO5	2	1	1	-	-	1	1	1	1	1	1	2
CO6	2	1	1	-	-	1	-	1	1	1	1	2

SEMESTER - II

20ECPL201 SDG NO. 4	CIRCUITS AND DEVICES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Analyse the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify KVL & KCL, Thevinin, Norton and Super Position Theorems
- Verify Reciprocity and Maximum Power Transfer Theorem
- Analyse the characteristics of Wave shaping circuits and Rectifier

LIST OF EXPERIMENTS :

1. Characteristics of PN Junction Diode.
2. Zener diode Characteristics & Regulator using Zener diode .
3. Common Emitter input-output Characteristics.
4. Common Base input-output Characteristics.
5. FET Characteristics.
6. SCR Characteristics.
7. Clipper and Clamper & FWR.
8. Verifications of Thevinin & Norton theorem.
9. Verifications of KVL & KCL.
10. Verifications of Super Position Theorem.
11. Verifications of maximum power transfer & reciprocity theorem.
12. Determination of Resonance Frequency of Series & Parallel RLC Circuits.

TOTAL: 45 PERIODS

**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS /
2 STUDENTS PER EXPERIMENT:**

S.No. EQUIPMENTS

1.	BC 107, BC 148, 2N2646, BFW10	- 25 each
2.	1N4007, Zener diodes	- 25 each
3.	Resistors, Capacitors, Inductors	- sufficient quantities
4.	Bread Boards	- 15 Nos
5.	CRO (30MHz)	- 10 Nos
6.	Function Generators (3MHz)	- 10 Nos

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Analyze the characteristics of basic electronic devices. (K4)
2. Design RL and RC circuits. (K5)
3. Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems. (K6)
4. Test the performance of clipper and clamper & FWR. (K6)
5. Analyze the characteristics of basic electronic devices such as Diode, BJT, FET and SCR. (K4)
6. Examine the input-output characteristics of CE and CB amplifiers. (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO2	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO3	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO4	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO5	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO6	3	3	1	3	1	-	-	-	-	-	2	3	3	2

SEMESTER - II

20ECTE201 SDG NO. 9	PCB DESIGN	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Analyze and interpret test results and measurements on electric circuits
- To predict the performance of electric circuits from device characteristics
- Design an electronic printed circuit board for a specific application using industry standard software

LIST OF EXPERIMENTS :

1. Introduction to PCB and OrCAD software.
2. Designing of schematic.
3. Designing of capture from OrCAD and getting positive for PCB manufacturing.
4. Soldering shop: Fabrication of DC regulated power supply.
5. PCB Lab: (a) Artwork & printing of a simple PCB. (b) Etching & drilling of PCB.
6. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
7. Testing of regulated power supply fabricated.

TOTAL: 30 PERIODS**LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:****S.No. EQUIPMENTS**

- | | | |
|----|--|--------------|
| 1. | Copper cladded base board | -15 Nos. |
| 2. | Hand Drilling machine | -15 Nos. |
| 3. | Soldering guns | -15 Nos. |
| 4. | Assorted electronic components for making circuits | -50 Nos. |
| 5. | OrCAD software | (15 users) |
| 6. | Copper solvent | -as required |
| 7. | PCs - 15 Nos | -15 Nos. |

OUTCOMES:**On completion of this course, the student should be able to**

1. Analyze the fabrication processes of printed circuit boards.
2. Perform the chemical processes by using negative/positive masks.

3. Perform the mechanical processes by using drilling, etching/routing, milling equipments as well as the developer and etcher machines.
4. Operate ORCAD software and design the PCB using ORCAD software.
5. Fabricate and test the PCB for regulated power supply.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	2	1	3	3	2	1	-	-	-	-	2	1	2	2
C02	2	1	2	3	1	1	-	-	-	-	2	3	2	2
C03	2	3	2	2	1	1	-	-	-	-	2	2	3	2
C04	3	2	2	3	3	2	-	-	-	-	2	1	3	2
C05	3	2	2	3	1	1	-	-	-	-	3	2	2	3

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING**6**

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS**6**

Basic Etiquette of virtual meeting – Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet – Screen Share - Jamboard - Feedback polling - Chatbox

(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING

6

Online Certification - Coursera – Udemy – Edx – Cisco – Online Practice Platforms - SkillRack – Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

(Practicals - Campus Commune Registration , Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLE SUITE

8

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts-Sites - Books - Blogger

(Practicals – Create google sheets and share - Create google Forms and share, Create Google Slide and share , Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS

4

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

1. <https://zety.com/blog/resume-tips>
2. <https://resumegenius.com/blog/resume-help/how-to-write-a-resume>
3. <https://www.hackerearth.com/recruit/>
4. <https://www.hackerrank.com/about-us>

Unit – II:Virtual Meetings

1. <https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students>
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general&cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB

3. <https://hygger.io/blog/top-10-best-group-meeting-apps-business/>
4. <https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/>

Unit - III: Online Learning

1. <https://www.coursera.org/browse>
2. <https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion>
3. <https://www.edx.org/course/how-to-learn-online>
4. <https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html>
5. <https://campuscommune.tcs.com/en-in/intro>
6. <https://www.freshersnow.com/tcs-campus-commune-registration/>
7. <https://www.infosys.com/careers/hackwithinfy.html>
8. <https://www.mindtree.com/blog/osmosis-2013-my-experiences>
9. <https://www.myamcat.com/knowning-amcat>
10. <https://www.admitkard.com/blog/2020/02/06/amcat/>

Unit IV: Google Suite

1. <https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/>
2. https://en.wikipedia.org/wiki/G_Suite
3. <https://blog.hubspot.com/marketing/google-suite>
4. <https://kinsta.com/blog/g-suite/>

Unit V: Presentation Skills

1. <https://www.mindtools.com/CommSkll/EmailCommunication.htm>
2. <https://www.grammarly.com/blog/email-writing-tips/>
3. <https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793>
4. <https://www.softwaretestinghelp.com/how-to-crack-the-gd/>
5. <https://www.mbauniverse.com/group-discussion/tips>
6. <https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/>
7. <https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421>
8. <https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/>
9. <http://www.garrreynolds.com/preso-tips/design/>

OUTCOMES:

On completion of this course, the student should be able to

1. Construct a suitable resume and registration procedure for online mock assessments. (K1)
2. Handle various virtual meeting tools. (K3)
3. Acquire exposure about online certification courses. (K4)
4. Get involved and work in a collaborative manner. (K2)
5. Gain knowledge in various presentation methodologies. (K1)
6. Apply knowledge to practice Google suite features and SWOT analysis. (K3)

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2
CO6	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - II

20HSMG201 SDG NO. 4 & 5	INTERPERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES**6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION**6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS**6**

Group formation –Teamwork – Identify others attitude and behaviour –

Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP

6

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE

6

Fostering trust and cooperation – Developing and maintain positive attitude – Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, “Personality Development and Soft Skills”, Oxford University Press, 2016.
2. B.N.Ghosh, “Managing Soft Skills for Personality Development”, McGraw Hill India, 2012.

OUTCOMES:

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

1. Develop a healthy relationship & harmony with others. (K1)
2. Practice respecting every human being. (K3)
3. Practice to eradicate negative temperaments. (K3)
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality. (K4)
5. Manage the cognitive abilities of an Individual. (K5)
6. Understanding the importance of public speaking and teamwork. (K2)

CO – PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1
CO6	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - III

20ECPC301 SDG NO. 4, 9	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions.
- To introduce the methods for simplifying Boolean expressions.
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits.

UNIT I LOGIC SIMPLIFICATION 9

Review of number systems and number representation – Binary codes – Code Conversion; Logic Simplification: Review of Boolean Algebra and De Morgan's Theorem – SOP and POS forms – Canonical forms – Karnaugh maps up to 5 variables- QuineMcClusky method - Implementation using logic gates.

UNIT II COMBINATIONAL LOGIC DESIGN 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip- Flops: Bistable elements, Latches, Flip-Flops, Flip flops – SR, JK, T, D,- operation and excitation tables, Triggering of FF- Master/Slave FF.

Registers and Counters: Shift registers -SISO, SIPO, PISO and PIPO, Universal Shift Register; up/down Counters; Design of Synchronous counters, Modulus- n Counter - Shift Register Counters -Ring Counters and Johnson Counter.

Clocked Sequential circuit: Analysis of clocked sequential circuits – concept of state – state diagram - state table, state reduction procedures by partitioning and implication chart-Moore/Mealy models; Design of synchronous sequential circuits- Serial Adder- Sequence detector.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Introduction to asynchronous sequential circuits - fundamental mode and pulse mode circuits - State Diagram and Excitation Table - Ripple Counters-

cycles and races, state reduction, race free assignments, –Pulse mode sequential circuits- Design. Hazards, Essential Hazards, Design of Hazard free circuits

UNIT V MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES 9

Memory Devices: Basic memory structure – ROM - PROM – EPROM – EEPROM – EAPROM, RAM – Static and dynamic RAM.

PLDs: PLA, PAL, PROM, Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. – CPLD. Field Programmable Gate Arrays (FPGA).

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 5th Edition, Pearson, 2014.
2. S. Salivahanan, S. Arivazhagan, “Digital Circuits and Design”, Oxford Press India, 2018 (5th Edition).
3. R P Jain, “Modern Digital Electronics”, McGraw Hill India, 2009 (4th Edition).

REFERENCES:

1. Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011.
3. S.Salivahanan and S.Arivazhagan, “Digital Electronics”, 1st Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini, “Digital Electronics”, Wiley, 2014.
5. A.Anand Kumar, “Fundamentals of Digital Circuits”, 4th Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal, “Digital Electronics”, McGraw Hill Education Private Limited, 2016.
7. Donald P Leach, Albert Paul Malvino and GoutamSaha, “Digital Principles and Applications” McGraw Hill, India – 2014 (8th Edition – SIE).

WEB REFERENCES:

1. <http://nptel.ac.in/courses/117106086/1>

2. <http://web.iitd.ac.in/~shouri/eel201/lectures.php>
3. <https://www.allaboutcircuits.com/textbook/digital/>
4. <http://nptel.ac.in/courses/117103064/>

ONLINE RESOURCES:

1. <https://www.adelaide.edu.au/course-outlines/108280/1/sem-2/> - University of Adelaide
2. <http://jjackson.eng.ua.edu/courses/ece480/> - The University of Alabama
3. http://www.ee.ic.ac.uk/pcheung/teaching/ee2_digital/index.html - Imperial College London

OUTCOMES:

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

1. Utilize Boolean algebra and K-map as tool and the knowledge of number systems and codes, to simplify and design logic circuits.(K3)
2. Design and analyze the operation of Combinational Circuits from the description of a logical function(K2)
3. Design and analyze the operation of Synchronous Sequential Circuits from the description of a logical function(K4)
4. Design and analyze the operation of Asynchronous Sequential Circuits from the description of a logical function(K5)
5. Describe the function, characteristics and structure of different memory systems, programmable logic devices.(K6)
6. Describe the working of digital integrated circuits.(K1)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	-	-	-	1	-	-	-	2	3	2
CO2	3	3	3	3	-	-	-	1	2	2	-	2	3	2
CO3	2	2	3	3	-	-	-	-	2	2	-	1	3	2
CO4	3	1	2	1	-	-	-	2	1	1	-	1	3	2
CO5	3	2	3	1	-	-	-	1	2	1	-	1	3	2
CO6	3	2	3	1	-	-	-	1	2	1	-	1	3	2

SEMESTER - III

20ECPC302 SDG NO. 3,4,7,15	ELECTROMAGNETIC FIELDS AND WAVEGUIDES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts
- To understand signal propagation at radio frequencies and analyse the rectangular and circular waveguides

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.

UNIT II ELECTROSTATICS

9

Electric charge, Coulomb's law, Electric field due to Line, Surface, Volume charge densities, Electric flux, Electric flux density, Gauss's law and applications, Electric potential, Potential gradient-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 and energy density, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Point form of 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, Law of no magnetic monopoles, Ampere's law, Biot-Savart law and applications, Magnetic field intensity, Magnetic flux density, Gauss's law, Magnetic vector potential, Lorentz force equation, Boundary conditions and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy and Magnetic energy density, Magnetic forces and torques

Applications – CRT – magnetic deflection, Magnetic brake, Linear motor, Time Varying Field: Induction, Faraday's law, Lenz's law.

UNIT IV TIME-VARYING FIELDS AND MAXWELL'S EQUATIONS 9

Faraday's law, Lenz's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector.

UNIT V WAVEGUIDES 9

Introduction to Rectangular and Circular Waveguides, Solutions of field Equations in Rectangular Co-ordinates, TE_{mn} & TM_{mn} Modes in Rectangular Waveguides, solutions of a field equations in cylindrical coordinates, TE_{mn} & TM_{mn} Modes in Circular Waveguides, Impossibility of TEM waves in Rectangular wave guides, Waveguide Parameters — Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity, Dominant and Degenerated Modes, Power Transmission and Power losses in Rectangular and Circular Waveguides

TOTAL : 45 PERIODS

TEXT BOOKS

1. D.K. Cheng, "Field and Wave Electromagnetics", 2nd Edition, Pearson (India), 1989. (UNIT I - IV).
2. John. D. Ryder, "Network Lines and Fields", 2nd Edition, PHI Learning, 2005. (Unit V).

REFERENCES:

1. D.J. Griffiths, "Introduction to Electrodynamics", 4th Edition, Pearson (India), 2013.
2. M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford (Asian Edition), 2015.
3. E. C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.

WEB RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-002-electromagnetic-field-theory-a-problem-solving-approach-spring-2008/textbook-contents/>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/2340/electromagnetic-fields>
2. <https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/index.htm>

OUTCOMES:

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

1. Apply fundamentals of Vector analysis in 3D coordinate systems. (K1)
2. Review the basic concepts and laws in Electromagnetics to Compute the field quantities. (K2)
3. Examine the behavior of materials in Electric and Magnetic fields.(K3)
4. Derive Maxwell's equations and wave equations for static and time varying fields. (K3)
5. Discuss propagation of Electromagnetic waves in lossy and lossless mediums. (K3)
6. Analyze the characteristics of TE and TM waves in rectangular and cylindrical waveguides. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	1	1	-	1	1	1	1
CO2	3	2	2	-	-	-	-	1	1	-	1	1	1	1
CO3	3	2	2	-	-	-	-	1	1	-	1	1	1	1
CO4	3	2	2	-	-	-	-	1	1	-	1	1	1	1
CO5	3	2	2	-	-	-	-	1	1	-	1	1	1	1
CO6	3	2	2	-	-	-	-	1	1	-	1	1	1	1

SEMESTER - III

20ECPC303 SDG NO. 3,4,11	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the fundamentals and properties of signal & systems
- To know the methods of characterization of LTI systems in time domain and frequency domain
- To analyze continuous time signals and system using Fourier and Laplace transforms
- To analyze discrete time signals and system using Fourier and Z transforms
- To analyze analog and discrete time systems, connected in series and parallel

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Representation of Continuous and discrete time signals, 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

Fourier series representation of continuous time periodic signals - properties of continuous time Fourier series, Fourier Transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform - Laplace Transforms and properties.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Properties of continuous time LTI system - Differential Equation- Causal continuous time LTI system described by differential equations -Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling – properties of discrete time LTI system, Causal discrete time LTI system described by difference equations. Fourier series representation of discrete time periodic signals, properties of discrete time

Fourier series, Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

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: 45 PERIODS

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015. (Unit 1- V).

REFERENCES:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.

WEB REFERENCES:

1. https://www.tutorialspoint.com/signals_and_systems/index.htm

ONLINE RESOURCES:

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>
2. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/assignments/>

OUTCOMES:

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

1. Classify the signals and systems. (K2)
2. Represent signals in the time domain and frequency domain. (K3)
3. Determine the Fourier/ Laplace of functions using the fundamental formulae and using their properties for continuous time functions.(K3)
4. Compute the response of the LTI system in the time domain and frequency domain. (K3)

5. Convert Continuous time signals to discrete time signals and determine Z transform using the fundamental formulae and using their properties for discrete time systems. (K2)
6. Realize systems in Direct form I / II or in parallel. (K3)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	1	1	1	-	-	-	-	-	-	-	1	2
C02	3	3	1	-	-	-	-	-	-	-	-	-	1	2
C03	3	3	1	1	-	-	-	-	-	-	-	-	1	2
C04	3	3	1	2	1	-	-	-	-	-	-	-	1	2
C05	3	3	1	-	1	-	-	-	-	-	-	-	1	2
C06	3	3	1	2	-	-	-	-	-	-	-	-	1	2

SEMESTER - III

20ECPW301 SDG NO. 4 & 9	R PROGRAMMING				L	T	P	C
	WITH LABORATORY				3	0	2	4

OBJECTIVES:

- To Understand the environment of R programming
- To obtain knowledge in the various structural aspects of R
- To utilize the libraries in the R programming for various mathematical functions
- To use the libraries for real time analysis of data and its plotting prospects
- To study the basics of machine learning and its implementation using R

UNIT I INTRODUCTION

9

Introduction, How to run R, R Sessions, and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II BASIC OF R PROGRAMMING

9

R Programming Structures, Control Statements, Loops, Looping Over Nonvector Sets, If-Else, Arithmetic and Boolean Operators and values, Default

Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary SearchTree.

UNIT III MATHEMATICAL RELATIONS IN R 9

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability - Cumulative Sums and Products - Minima and Maxima - Calculus, Functions For Statistical Distribution, Sorting, Linear Algebra operation on Vectors and Matrices, Extended Example: Vector cross Product - Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV VISUALISATION USING AND BASICS OF MACHINE LEARNING 9

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot () Function – Customizing Graphs, Saving Graphs to Files. Machine learning - Introduction- Classifications - Supervised learning-unsupervised learning - reinforcement learning - Algorithms - Case studies.

UNIT V STATISTICAL MODELS AND ITS IMPLEMENTATION 9

Probability Distributions, Normal Distribution - Binomial Distribution - Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA. Linear Models, Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression - other Generalized Linear Models - Survival Analysis, Nonlinear Models, Splines - Decision- Random Forests.

R PROGRAMMING LAB-LIST OF EXPERIMENTS: 15

1. Datatypes
2. Functions
3. Creating and manipulating a vector
4. Creating and manipulating matrix
5. Creating and operations on Factors
6. Data Frames-Lists-Operators-PLOT Function in R to customize graphs.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. The Art of R Programming, Norman Matloff, CengageLearning.
2. Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill International, Auckland.

REFERENCES:

1. Lander, "R for Everyone", Pearson
2. Venables, W. N., and Ripley, B. D. (2000), "S Programming", Springer-Verlag, New York.
3. Weisberg, S. (1985), "Applied Linear Regression", 2nd ed., John Wiley & Sons, New York.
4. Zar, J. H. (1999), "Biostatistical Analysis", Prentice Hall, Englewood Cliffs, NJ

WEB REFERENCES:

1. <https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf>.
2. <https://link.springer.com/content/pdf/10.1007%2F978-0-387-79054-1.pdf3>.<https://link.springer.com/content/pdf/10.1007%2F978-0-387-93837-0.pdf>

ONLINE RESOURCES:

1. <https://www.statmethods.net/r-tutorial/index.html>
2. <https://www.javatpoint.com/r-tutorial>

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Apply fundamentals of Vector analysis in 3D coordinate systems. (K1)
2. Review the basic concepts and laws in Electromagnetics to Compute the field quantities. (K2)
3. Examine the behavior of materials in Electric and Magnetic fields. (K3)
4. Derive Maxwell's equations and wave equations for static and time varying fields. (K3)
5. Discuss propagation of Electromagnetic waves in lossy and lossless mediums. (K3)
6. Analyze the characteristics of TE and TM waves in rectangular and cylindrical waveguides. (K3)

CO - PO - PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	2	2	-	-	-	-	1	1	-	1	1	1	1
C02	3	2	2	-	-	-	-	1	1	-	1	1	1	1
C03	3	2	2	-	-	-	-	1	1	-	1	1	1	1
C04	3	2	2	-	-	-	-	1	1	-	1	1	1	1
C05	3	2	2	-	-	-	-	1	1	-	1	1	1	1
C06	3	2	2	-	-	-	-	1	1	-	1	1	1	1

SEMESTER - III

20BSMA301 SDG NO. 4	LINEAR ALGEBRA, PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement
- To know the importance of partial differential equations in modeling various engineering problems
- To introduce the techniques of Fourier and Z- Transforms to analyze continuous and discrete signals

UNIT I VECTOR SPACES**15**

Vector spaces – Subspaces – Linear combinations– Linear independence and linear dependence – Bases and dimensions.

UNIT II LINEAR TRANSFORMATION AND INNER PRODUCT SPACES**15**

Linear transformation - Null and range spaces - Dimension theorem (Statement only) - Matrix of a linear transformation - Inner product - norm - Gram Schmidt orthogonalization process.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS**12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Integral surface passing through a given curve - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT IV FOURIER TRANSFORMS

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z- TRANSFORMS AND DIFFERENCE EQUATIONS

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Friedberg A.H., Insel A.J. and Spence L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004. Unit I (Sec. 1.2, 1.3, 1.4 (linear combinations only), 1.5 & 1.6), Unit II (Sec. 2.1, 2.2, 6.1 & 6.2) (In Units I & II to include theorem statements only).
2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi. Unit III (Sec. 1.2, 1.5, 1.7, 1.11, 1.13, 1.14), Unit IV (Sec. 4.1, 4.2, 4.3, 4.6), Unit V (Sec. 5.1, 5.2, 5.3, 5.4, 5.5).

REFERENCES:

1. Strang G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
2. Lay D. C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
3. Kumaresan S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
4. James G., "Advanced Modern Engineering Mathematics", Pearson Education, 2007.

WEB RESOURCES

1. <https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/>
2. <https://nptel.ac.in/courses/111/106/111106135/>
3. <https://nptel.ac.in/courses/111/103/111103021/>

ONLINE RESOURCES:

1. <https://www.khanacademy.org/math/linear-algebra>
2. <https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/>

3. <https://freevideolectures.com/course/3244/advanced-engineering-mathematics>

OUTCOMES:

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

1. Determine the basis and dimension of a finite dimensional vector space. (K3)
2. Compute the Matrix, Range space and Null space of a linear transformation. (K3)
3. Construct orthonormal bases for inner product spaces using Gram Schmidt process. (K3)
4. Formulate and Solve Linear and non-linear Partial differential equations. (K3)
5. Find the Fourier transform, Inverse Fourier Transform, Fourier sine and cosine transforms of simple functions. (K3)
6. Apply Z-transforms to solve difference equations. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1
CO3	3	3	2	2	1	-	-	-	-	-	-	1
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	2	2	1	-	-	-	-	-	-	1
CO6	3	3	2	2	1	-	-	-	-	-	-	1

SEMESTER - III

20ECPL301 SDG NO. 3,4,9	DIGITAL CIRCUITS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Get practical experience in design, realisation and verification of Demorgan's Theorem
- Design Full/Parallel Adders and Subtractors

- Design and learn Multiplexer using logic gates, Demultiplexer and Decoder
- Verify the function of Flip-Flops
- Design Shift registers and Counters using Flip flops

LIST OF ANALOG EXPERIMENTS:

1. To realize Basic gates (AND, OR, NOT) From Universal Gates (NAND & NOR).
2. To verify
 - (a) Demorgan's Theorem for 2 variables
 - (b) The sum-of product and product-of-sum expressions using universal gates
3. To design and implement 4-bit Parallel Adder/ subtractor using IC 7483
4. To realize
 - (a) 4:1 Multiplexer using gates
 - (b) 3-variable function using IC 74151(8:1 MUX)
5. To realize
 - (a) 1:8 Demultiplexer and
 - (b) 3:8 Decoder using IC74138
6. To design 4 bit comparator circuit using logic gates
7. To realize the following flip-flops using NAND Gates:
 - (a) Clocked SR Flip-Flop
 - (b) JK Flip-Flop
8. To realize the following shift registers using IC7474:
 - (a) SISO
 - (b) SIPO
 - (c) PISO
 - (d) PIPO
9. To realize the Ring Counter and Johnson Counter using IC7476
10. To realize the Mod-N Counter using IC7490
11. To design 4 bit synchronous Counter using JK Flip flops - IC7476
12. To design 4 bit Ripple counter using JK Flip flops - IC7476

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No. EQUIPMENTS

1. IC7404, IC7408, IC 7432, IC7486, IC 7400 & IC 7402
2. IC 7483- 4 bit Parallel Adder/ Subtractor
3. IC 7476- JK Flip flops
4. IC 7474- D Flip flops
5. Digital Trainer Kit- 15 Nos

VIRTUAL LAB:

1. <http://vlabs.iitkgp.ernet.in/dec/>
2. <http://cse15-iiith.vlabs.ac.in/Introduction.html>

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Design, Test and Evaluate various combinational circuits such as adders and subtractors. (K6)
2. Design, Test and Evaluate various combinational circuits comparators, multiplexers and demultiplexers. (K6)
3. Construct flips-flops using NAND gates and verify their functionality. (K3)
4. Construct synchronous and asynchronous counters and verify their functionality. (K3)
5. Construct the types of shift registers and verify their functionality. (K3)
6. Identify the various digital ICs and simply the digital circuits. (K1)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	3	-	-	-	1	2	-	-	-	3	3
C02	3	3	2	3	-	-	-	1	2	-	-	-	3	3
C03	3	3	2	2	-	-	-	1	2	-	-	-	3	3
C04	3	3	2	3	-	-	-	1	2	-	-	-	3	3
C05	3	3	2	3	-	-	-	1	2	-	-	-	3	3
C06	3	3	2	3	-	-	-	1	2	-	-	-	3	3

SEMESTER - III

20ECTE301 SDG NO. 4,11,15	LIVE-IN-LAB - I	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation (Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade

TOTAL: 45 PERIODS

OUTCOMES:

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

1. List the problems and conduct literature survey to identify the gap and come up with an application oriented research problem in the specific domain.(K1)
2. Understand the project characteristics and explore necessary tools and components needed at various stages of the project(K2)
3. Design and validate the proposed system using simulation.(K3)
4. Develop the Prototype of the proposed system by adapting Industrial safety standards and best financial management practices(K5)
5. Analyze the obtained results and prepare a technical report.(K4)
6. Evaluate the project and go for journals and patents publication.(K5)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	3	2	2	2	2	2	2	3	2	2	3	3	3
C02	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C03	3	3	3	2	3	3	2	2	3	3	3	3	3	3
C04	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C05	2	2	2	1	2	1	1	1	3	2	3	3	3	2
C06	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20ECTP301 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

APTITUDE & COGNITIVE SKILLS - PHASE 1**COURSE OBJECTIVE:**

- To educate and enrich the students on quantitative ability, reasoning ability, and verbal ability.

UNIT I QUANTITATIVE ABILITY - I**6**

Problems on Trains - Time and Distance - Height and Distance - Time and Work.

UNIT II QUANTITATIVE ABILITY - II**6**

Problems on Ages - Alligation or Mixture - Chain Rule - Simple Interest - Simple Equation - Theory Of Equation.

UNIT III REASONING ABILITY - I**6**

Analytical Reasoning - Pipes and Cistern - Logical Problems - Logical Games - Logical Deduction - Data Sufficiency - Arithmetic Reasoning.

UNIT IV VERBAL ABILITY - I**6**

Idioms & Phrases - Synonyms - Antonyms - Classification.

UNIT V CREATIVITY ABILITY – I**6**

Venn Diagrams, Cube and Cuboids, Dice, Cubes and Dice, Figure Matrix

TOTAL : 30 PERIODS**REFERENCES:**

- 1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
- 2) Sarvesh Verma, "Quantum CAT"
- 3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
- 4) Arun sharma, "Verbal Ability and Reading Comprehension"

**PROBLEM SOLVING USING C PROGRAMMING AND EMBEDDED C
PROGRAMMING – PHASE 2**

COURSE OBJECTIVE:

- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming language.
- To provide exposure to problem-solving through programming.
- To train the student to the basic concepts of the C-programming and MATLAB programming language.
- To give the student hands-on experience with the concepts

UNIT I INTRODUCTION TO PRINCIPLES OF PROGRAMMING**6**

Introduction to Programming - Programing Domain : Artificial Intelligence- Systems Programming - Assembly Level Languages - Problem solving using Algorithms and Flowcharts.

UNIT II INTRODUCTION TO C PROGRAMMING**6**

Features of C and its Basic Structure - Simple C programs - Constants - Integer Constants - Real Constants - Character Constants - String Constants Floating-point Numbers - The type cast Operator - Interactive Programming.

Operators Expressions and Control statement - The goto statement - The if statement - The if-else statement - Nesting of if statements - The conditional expression - The break statement and continue statement.

UNIT III ARRAYS, STRINGS AND POINTERS**6**

Arrays - Multidimensional Arrays - Strings, Basics of Pointers - Pointer Arithmetic - Similarities between Pointers and One-dimensional Arrays Structures - Unions And Functions - Basics of Structures - Arrays of Structures - Pointers to Structures - Function Basics - Function Prototypes and Passing Parameters - Structures and Functions Recursion.

UNIT IV BASICS OF EMBEDDED C**6**

Introduction to Embedded C Programming Language - Difference between C and Embedded C- Variables -Control Structure in Embedded C - Functions and constants in Embedded C - Data Types - Arithmetic operations - program structure - Operators - Bit masking - Bit Extracting- Bit monitoring.

UNIT V MICROCONTROLLER PROGRAMMING**6**

Introduction of Microprocessor- Microcontroller - 8051 Architecture - Programming 8051 microcontroller -Port Register- Basic Embedded C Program - Keil IDE Software Installation - Proteus Simulation software Installation -Steps to burn/embed a program in the microcontroller 8051 microcontroller programming using embedded C.

TOTAL : 30 PERIODS**REFERENCES:**

1. Balagurusamy, "Programming in ANSI C", Tata McGraw-Hill Education, 2008.
2. Stephen G. Kochan, "Programming in C" (3rd Edition), Sams, 2004.
3. Stephen G. Kochan, "Programming in C", III Edition, Pearson Education.
4. Pond, "Embedded C", 1e Pearson Edition.
5. MAZIDI "The 8051 Microcontroller and Embedded Systems: Using Assembly and C" Pearson.
6. Ashok K.Pathak, "Advanced Test in C and Embedded System Programming" BPB publication.
7. AVR Microcontroller and Embedded Systems: Using Assembly and C, 1e, azidi/ Naimi / Naimi.
8. Muhammed Ali Mazidi The 8051 Microcontroller and Embedded Systems, Pearson.

ONLINE RESOURCES

1. <https://nptel.ac.in/courses/108/102/108102045/>
2. <https://www.coursera.org/courses?query=embedded%20systems>

WEB RESOURCES

1. https://www.tutorialspoint.com/embedded_systems/index.htm

COURSE OUTCOMES :

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

1. Analyze their quantitative ability. (K4)
2. Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)

3. Create their verbal ability through vocabulary building and grammar. (K6)
4. Evaluate the situations to analyse the computational methods in order to identify and abstract the programming task involved. (K5)
5. Analyse tasks in which the numerical techniques are applicable in order to apply them to write, edit, compile, debug, correct, recompile and run programs. (K4)
6. Understanding a step by step process to burn/embed a program in the controller. (K2)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

SEMESTER - III

20MGMC301 SDG NO. 4	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

At the end of the course, the student is expected to

- To know about Indian constitution
- To know about central government functionalities in India
- To know about state government functionalities in India
- To know about Constitution function
- To Know about Constitutional remedies

UNIT I INTRODUCTION

6

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT 6

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT 6

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS 6

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

UNIT V CONSTITUTIONAL REMEDIES 6

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.
3. M.V. Pyle (2019), "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
4. P.M. Bakshi, (2018), "Constitution of India", Universal Law Publishing, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalandhar.

OUTCOMES:

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

1. Understand about Constitution & Fundamental rights of citizens. (K2)
2. Interpret the structure and hierarchy of Central and State Government. (K2)

3. Analyze the functions of Judiciary, Parliament and its constituent members. (K4)
4. Evaluate the functions and boundaries of Central and State Governments in respect of their powers, duties and Centre-State relationship. (K5)
5. Remember the Indian social structure in respect of caste, religion, language, rights to citizens particularly rights to women, children and weaker sections. (K1)
6. Analyze remedies and rights available to India Citizens. (K4)

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	-	-	-	-	-	1	-	-	-	-	-	-
C02	-	-		-	-	1	-	-	-	-	-	-
C03	-	-	-	-	-	1	-	-	-	-	-	-
C04	-	-	-	-	-	1	-	-	-	-	-	-
C05	-	-	-	-	-	2	-	3	-	-	-	-
C06	-	-	-	-	-	2	-	2	-	-	-	-

SEMESTER - IV

20ECPC401 SDG NO. 4	COMMUNICATION THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of various amplitude modulations and their spectral characteristics
- To study the concepts of various angle modulation and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To study the fundamentals of sampling, quantization and pulse modulation techniques

UNIT I AMPLITUDE MODULATION 9

Elements of Communication systems – Communication Channels – Need for Modulation - Amplitude Modulation- DSBSC, DSBFC, SSB, ISB, VSB - Modulation index, Spectra, Power relations and Bandwidth of AM – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope – comparison of different AM techniques, AM Demodulators: Envelope Detector, Coherent Detection of DSB – SC, SSB – SC – Costas Receiver – Frequency Translation - Superheterodyne Receiver.

UNIT II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth of FM – PM to FM Conversion – and FM to PM Conversion – FM Generation: Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator – Balanced Slope Detector, Foster Seeley Discriminator, Ratio Detector, PLL Demodulator, Quadrature FM Demodulator – FM Receivers.

UNIT III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNIT IV NOISE CHARACTERIZATION**9**

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise – In-phase and quadrature components, Envelope and Phase Components – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and deemphasis for FM.

UNIT V SAMPLING & QUANTIZATION**9**

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education, 2014. (UNIT I-IV)
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley, 2014. (UNIT I-V)

REFERENCES:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, "Electronic Communications", 4th Edition, PHI, 2006.
3. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd Edition, 1991.
4. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2007.
5. H P Hsu, "Schaum Outline Series – Analog and Digital Communications", TMH, 2006.
6. Couch.L., "Modern Communication Systems", Pearson, 2001.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee16/preview
2. <https://nptel.ac.in/courses/117102059/>

ONLINE RESOURCES:

1. <https://freevidelectures.com/course/2590/introduction-to-communication-theory>

OUTCOMES:**At the end of the course, the student should be able to**

1. Apply various signals and its characteristics to design a communication system. (K3)
2. Interpret various amplitude modulation techniques to model a communication system.(K2)
3. Discuss angle modulation techniques and compare various analog modulation techniques.(K2)
4. Formulate the properties of random processes to generate a mathematical model for a noise in a communication system.(K5)
5. Review and analyse the noise characteristics to evaluate the performance of analog modulation systems.(K4)
6. Examine the conversion of continuous systems to discrete systems to develop pulse communication systems. (K5)

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	1	-	-	3	-	-	-	-	-	1
CO2	3	3	3	-	3	-	-	3	-	-	-	-	-	1
CO3	3	3	3	-	3	-	-	3	-	-	1	1	-	1
CO4	3	-	1	-	1	-	-	1	-	-	-	-	-	1
CO5	3	3	3	-	1	-	-	3	-	-	1	1	-	1
CO6	3	3	3	-	3	-	-	3	-	-	3	3	-	1

SEMESTER - IV

20ECPW401 SDG NO. 4	ELECTRONIC CIRCUITS WITH LABORATORY				L	T	P	C
					3	0	2	4

OBJECTIVES:

- To understand the methods of biasing BJT
- To design and analyze single stage and multistage amplifier circuits
- To impart knowledge about feedback amplifiers and oscillators
- To inculcate knowledge about tuned amplifier
- Explore the characteristics of Power amplifier

UNIT I BIASING 9

Need for biasing - DC load line analysis of biasing circuits - Operating point- Design of biasing circuits: Fixed bias configuration, Emitter bias configuration, Voltage divider bias configuration- Bias stabilization - Stability factors.

UNIT II SINGLE AND MULTI STAGE AMPLIFIERS 9

AC load line - BJT small signal model- Analysis of CE, CB, CC amplifier-Gain and frequency response-MOSFET small signal model-Analysis of CS and Source follower-Gain and frequency response-High frequency analysis-Need of multistage amplifier-Cascade, Cascode and Differential amplifier.

UNIT III FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Basic principles and types of feedback-Gain of an amplifier employing feedback-Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier. Voltage series, voltage shunt, Current series and current shunt Feedback configurations. Use of positive feedback-Barkhausen criterion for oscillations-Different oscillator circuits-tuned collector-Hartley, Colpitts, Phase shift, Wien Bridge and Crystal oscillator.

UNIT IV TUNED AMPLIFIERS AND MULTIVIBRATORS 9

Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

Analysis and Design of Bistable, Monostable, Astable, Multivibrators and Schmitt Trigger using Transistors.

UNIT V LARGE SIGNAL AMPLIFIERS 9

Difference between voltage and Power amplifier- Importance of impedance matching in amplifiers- Class A, Class B, Class AB and Class C amplifiers-Single ended power amplifiers-Push pull amplifier and Complementary symmetry push-pull amplifier.

LIST OF EXPERIMENTS : 15

1. Frequency Response of CE, CB, CC and CS amplifiers.
2. Cascode and Cascade amplifiers.
3. Analysis of frequency response FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software using spice.
4. Analysis of Cascode and Cascade amplifiers using Spice.

5. Analysis of Frequency Response of BJT and FET using Spice.
6. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky, "Electron Devices and Circuits: Theory and Practice", Prentice Hall of India, 10th Edition, 2009.
2. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.
3. Adel S.Sedra and Kenneth Smith, "Microelectronic Circuits", Oxford University Press, Sixth edition, 2009.

REFERENCES:

1. Millman and Halkias.C, "Integrated Electronics", Tata McGraw Hill, 2nd Edition, 2010.
2. Millman. J and Taub H, "Pulse Digital and Switching Waveforms", Tata McGraw Hill, 3rd Edition, 2011.
3. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill ltd., 2nd Edition, 2009.
4. Thomas.L.Floyd, "Electronic Devices: Conventional Current version", Pearson, 9th Edition, 2015.
5. B. Visvesvara Rao, K.Raja Rajeswari, P.Chalam Raju Pantulu and K.Bhaskara Rama, "Electronic Circuit Analysis", Pearson, 1st Edition, 2012.

WEB REFERENCES:

1. <https://nptel.ac.in/courses/108107142/>
2. <https://www.digimat.in/nptel/courses/video/108102095/L41.html>
3. <https://nptel.ac.in/courses/108102095/>

ONLINE RESOURCES:

1. <https://www.coursera.org/learn/transistor-field-effect-transistor-bipolar-junction-transistor>
2. https://www.tutorialspoint.com/amplifiers/tuned_amplifiers.htm
3. <https://www.udemy.com/course/introduction-to-semiconductor-diodes-and-transistors/>
4. https://www.electronics-tutorials.ws/amplifier/amp_1.html

OUTCOMES:

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

1. Calculate the stability factors for the various types of biasing circuits using different transistor configurations.(K3)

- Design the small signal hybrid model of various configurations of BJT and calculate the gain and bandwidth from the frequency response analysis of single stage and multi stage amplifiers.(K6)
- Design the small signal hybrid model of various configurations of FET and calculate the gain and bandwidth from the frequency response analysis of single stage FET amplifier.(K6)
- Design of Tuned amplifiers.(K6)
- Construct the different classes of large signal amplifiers to calculate their efficiencies & design and compare the amplifiers with and without feedback using BJT.(K3)
- Illustrate the idea of biasing, Stability and oscillations in amplifier.(K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	1	-	-	-	-	-	-	-	-	-	-	1	-
C02	3	2	-	2	-	-	-	-	-	-	-	-	2	1
C03	3	2	-	2	-	-	-	-	-	-	-	-	2	1
C04	3	-	-	2	2	-	-	-	-	-	-	-	2	1
C05	3	2	2	2	2	-	-	-	-	-	-	-	2	1
C06	3	2	2	2	2	-	-	-	-	-	-	1	2	1

SEMESTER - IV

20ECPW402 SDG NO. 4	LINEAR INTEGRATED CIRCUITS WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To learn the basic building blocks and characteristics of Operational Amplifiers
- To learn and design applications using Operational Amplifiers
- To introduce the theory and applications of analog multipliers, PLL and Timer Ics
- To learn the theory of ADC and DAC
- To Design waveform generators using operational amplifiers, voltage regulators and filters

UNIT I BASICS AND APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

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. 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.

UNIT III ANALOG MULTIPLIER, PLL AND TIMER ICs 9

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 synchronisation. Timer IC 555 and Multivibrators using 555 IC.

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.

UNIT V FILTERS WAVEFORM GENERATORS AND VOLTAGE REGULATORS 9

Sine-wave generators, Multivibrators, Triangular wave generator and Sawtooth wave generator, ICL8038 function generator, IC Voltage regulators: Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Low-pass, high-pass and band-pass Butterworth filters, Switched capacitor filter IC MF10.

LIST OF EXPERIMENTS 15

Design and test the following circuits

1. Instrumentation amplifier and Schmitt Trigger using op-amp.
2. Active low-pass, High-pass and band-pass filters.
3. Phase shift and Wien bridge oscillators using Op-amp.

4. Astable and Monostable multivibrators using NE555 Timer.
5. DC power supply using LM317 and Lm723.
6. Simulate using PSPICE Full wave precision rectifier using Op-amp, Astable and Monostable using 741 Timer and A/D converter.
7. Design and simulate using PSPICE Voltage Controlled Oscillator, Analog Multiplier, and PLL as frequency multiplier.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V).
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata McGraw Hill, 2016 (Unit I –V).

REFERENCES:

1. Ramakant A.Gayakwad, "OPAMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
2. S.Salivahanan, V.S.KanchanaBhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.
3. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, PHI, 2001.
4. B.S.Sonde, "System Design using Integrated Circuits", 2nd Edition, New Age Pub, 2001.
5. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5th Edition, 2009.
6. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 4th Edition, 2001.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee13/preview
2. <https://nptel.ac.in/courses/108108111/>
3. <http://web.iitd.ac.in/~shouri/eel782/lectures.php>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/2915/linear-integrated-circuits>
2. <https://e-box.co.in/linear-integrated-circuits.shtml>

OUTCOMES:

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

1. Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques. (K2)
2. Elucidate and analyse the linear applications of operational amplifiers and special application ICs. (K4)
3. Elucidate and analyse the non-linear applications of an operational amplifier and special application ICs. (K4)
4. Demonstrate the working of multivibrators using special application IC 555 and general-purpose operational amplifier. (K3)
5. Classify and comprehend the working principle of data converters. (K4)
6. Illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication. (K4)

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C01	3	1	2	2	-	2	-	-	-	-	2	2	3	2
C02	3	1	3	2	-	2	-	-	-	-	2	2	3	2
C03	3	1	3	2	-	2	-	-	-	-	2	2	3	2
C04	3	1	3	2	-	2	-	-	-	-	2	2	3	2
C05	3	1	3	2	3	2	-	-	2	3	2	2	3	2
C06	3	1	3	2	3	2	-	-	2	3	2	2	3	2

SEMESTER - IV

20ECPC402 SDG NO. 4, 11	MICROPROCESSOR AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller and ARM processor.
- To design a microcontroller based system.

UNIT I 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 MICROCONTROLLER 9

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

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 INTRODUCTION TO EMBEDDED SYSTEM DESIGN AND REAL TIME SYSTEMS 9

Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications- System analysis and architecture design – Structure of a Real Time System -- Estimating program run times – Task assignment and scheduling.

UNIT V ARM PROCESSOR AND PERIPHERALS 9

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, 2nd Edition, Prentice Hall of India, 2007. (UNIT I & III).
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, 2nd Edition, Pearson education, 2011. (UNIT II).
3. Marilyn Wolf, “Computers as Components - Principles of Embedded

Computing System Design”, 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT IV, V).

4. Jane W.S.Liu, “Real Time Systems”, Pearson Education, Third Indian Reprint, 2003.(UNIT IV).

REFERENCES:

1. DoughlasV.Hall, “Microprocessors and Interfacing, Programming andHardware”,TMH, 2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 3rd Edition, Tata McGraw Hill, 2012.
3. Lyla B.Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013.
4. C.M.Krishna, Kang G.Shin, “Real-Time Systems”, International Editions, McGraw Hill, 1997.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee42/preview
2. <https://nptel.ac.in/courses/108105102/>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/3018/microprocessors-and-microcontrollers>
2. <http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html>

OUTCOMES:

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

1. Restate the architecture of 8086,ARM and 8051.(K1)
2. Identify the different ways of interfacing memory, I/O with 8086,ARM and 8051.(K2)
3. Apply the programming using ALP in 8086,ARM and 8051 for arithmetic logical and real time applications.(K3)
4. Analyze the interfacing concept of different programmable interfacing devices.(K4)
5. Developing programming concepts for various applications.(K4)
6. Design microprocessor and microcontroller based applications.(K6)

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	2	-	-	2	3	2	2	3	2
CO6	3	1	3	2	-	2	-	-	-	-	2	2	3	2

SEMESTER - IV

20BSMA401 SDG NO. 4	PROBABILITY THEORY AND STOCHASTIC PROCESSES				L	T	P	C
					3	1	0	4

OBJECTIVES:

- To provide the mathematical background of random variables, standard distributions and random processes for application to signal processing and Communication theory

UNIT I RANDOM VARIABLES AND STANDARD DISTRIBUTIONS 12

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

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

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 INTRODUCTION TO STOCHASTIC PROCESS 12

Classification – Auto correlation functions – Cross correlation functions - Stationary process –Ergodic process-Power Spectral Density.

UNIT IV MODELS OF RANDOM PROCESSES 12

The Bernoulli process - The Gaussian process - Poisson process - Markov process - Markov chain.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS**12**

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

TOTAL: 60 PERIODS**TEXTBOOKS:**

1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007. Unit-I Chapter-2, Chapter-3 (Sections 3.1-3.5), Chapter-4 (Sections 4.1-4.8, 4.10 & 4.11), Chapter 6 (Section 6.2) Unit-II Chapter 5 (Sections 5.1-5.7), Chapter 6 (6.8 & 6.10) Unit-III Chapter-8 (8.1-8.7), 10.5 Unit-IV Chapter 10 (Section 10.2, 10.4, 10.5(10.5.1-10.5.6), 10.6, 10.7) Unit-V Chapter 9 (Sections 9.1-9.3)

REFERENCES:

1. Peebles P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.
2. Veerarajan T., "Probability and Statistics, Random Processes and Queueing theory", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi.
3. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes" PHI, 4th Edition, 2002.
4. Davenport, Probability and Random Processes for Scientist and Engineers, McGraw-Hill.
5. H. Stark & J.W. Woods: Probability, Random Processes and Estimations Theory for Engineers, (2/e), Prentice Hall.
6. E. Wong: Introduction to Random Processes, Springer Verlag.
7. W. A. Gardner: Introduction to Random Processes, (2/e), McGraw Hill.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ma30/preview
2. <https://nptel.ac.in/courses/111102111/>
3. <https://nptel.ac.in/courses/111/104/111104032/>
4. <http://www.ifp.illinois.edu/~hajek/Papers/probabilityJan13.pdf>
5. <https://www.ee.iitb.ac.in/~bsraj/courses/ee325/>

ONLINE RESOURCES:

1. <https://freevideolectures.com/course/2324/probability-and-random-processes>.
2. <http://www.nptelvideos.com/course.php?id=572>.

OUTCOMES:**Upon completion of the course, the student should be able to**

1. Compute the probability and statistical averages of one dimensional, two-dimensional discrete, continuous random variables and their standard distributions. (K3)
2. Calculate the Autocorrelation, Cross correlation, power spectral density and cross power spectral density of a random processes and linear system. (K3)
3. Calculate the limiting state probabilities of Markov chains and use Central limit theorem to find the approximate probabilities of the sum of large numbers of independent and identically distributed random variables and use transformation of random variables to find the joint and marginal probability density functions. (K3)
4. Explain Stationary, Ergodic, Markov, Poisson, Bernoulli and Gaussian processes. (K2)
5. Explain the properties of statistical averages of a random variable, random processes, Poisson process and linear system. (K2)
6. Determine the spectral properties of output when the input function is given to a linear system. (K3)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	-	-	-	-		-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1
CO4	3	3	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1
CO6	3	3	2	1	-	-	-	-	-	-	-	1

SEMESTER - IV

20BSCY201 SDG NO. 4,17	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the nature and facts about environment
- To find and implement scientific, technological, economic and political solutions to environmental problems

- To study the interrelationship between living organism and environment
- To provide the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.
-

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity. Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

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 (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies. Disaster management: floods, earthquake, cyclone and landslides – nuclear accidents and holocaust – case studies. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

UNIT III NATURAL RESOURCES 9

Forest resources: Use and over – exploitation, deforestation, case studies – Water resources: Use and over- utilization of surface and ground water – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, use of alternate energy sources - renewable and non renewable energy sources – Land resources: land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – Sustainable Development Goals – Water conservation: rain water harvesting, watershed management – Climate change: global warming, chemical and photochemical reactions in the atmosphere – acid rain, ozone layer depletion – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – Environmental Legislation & Laws: Environment (Protection) Act – 1986 Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labelling of environmentally friendly products (Ecomark) – Issues involved in enforcement of environmental legislation - central and state pollution control boards, role of non-governmental organization – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT**8**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental Impact Assessment(EIA) - role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS**TEXTBOOKS:**

1. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, “Environmental law”, Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) Pvt Ltd., Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India Pvt. Ltd., Delhi, 2014.
4. Rajagopalan. R, “Environmental Studies-From Crisis to Cure”, Oxford University Press, 2005.

OUTCOMES:

Upon successful completion of this course, student should be able to

1. Understand the relationship between the environment and human activities to maintain the ecological balance. (K1)

- Identify societal issues and implement suitable technological solutions to eradicate. (K3)
- Acquire skills for scientific problem solving related to environmental pollution and Disaster Management. (K3)
- Disseminate the need for the natural resources and its application to meet the modern requirements. (K2)
- Aware of environmental issues and Protection Acts to achieve the Sustainable Development Goals. (K2)
- Recognize the need for population control measures and the environmental based value.education concepts for attaining an eco-friendly environment. (K2)

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	-	-	1	2	-	1	1	-	2
CO2	2	2	2	-	2	2	3	1	2	2	-	2
CO3	1	1	1	1	-	1	1	-	1	2	-	1
CO4	2	2	2	2	1	1	1	-	1	1	1	1
CO5	2	2	1	-	-	1	1	-	-	-	1	-
CO6	1	1	1	1	1	1	1	1	1	1	1	1

SEMESTER - IV

20ECPL401 SDG NO. 4, 11	MICROPROCESSOR AND EMBEDDED SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Interface different I/Os with Microprocessors
- Be familiar with MASM
- Write programs for ARM

LIST OF EXPERIMENTS:**8086 Programs using kits and MASM**

- Basic arithmetic and Logical operations.
- Move a data block without overlap.

- Code conversion, decimal arithmetic and Matrix operations.
- Floating point operations, string manipulations, sorting and searching.

8051 Experiments using kits and MASM

- Basic arithmetic and Logical operations.
- Square and Cube program, Find 2's complement of a number.
- Unpacked BCD to ASCII.

Peripherals and Interfacing Experiments

- Traffic light controller.
- Stepper motor control.
- Digital clock.

ARM programs

- Interfacing ADC and DAC.
- Interfacing LED and PWM.
- Interfacing LCD.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to

- Write ALP for fixed and Floating Point and Arithmetic operations.(K3)
- Execute Programs in 8051 (K5)
- Interface various peripherals in 8086/8051.(K3)
- Execute Programs in ARM.(K5)
- Interface memory, A/D and D/A convertors with ARM system(K3)
- Formulate a mini project.(K6)

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	2	2	-	-	-	2	2	1	2	2
CO2	3	1	2	3	1	2	-	-	-	2	2	3	2	2
CO3	3	2	2	2	1	2	-	-	-	2	2	2	3	2
CO4	3	2	2	3	3	2	-	-	-	2	2	1	3	2
CO5	2	2	2	2	5	2	-	-	-	3	1	2	3	3
CO6	2	2	2	3	1	2	-	-	-	2	3	2	3	3

SEMESTER - IV

20ECTE401 SDG NO. 4,11,15	LIVE-IN-LAB - II	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation (Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

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

1. Conduct literature survey to identify the gap and an application oriented research problem in the specific domain(K4)
2. Design and validate the proposed system using simulation(K6)
3. Prototype the proposed system(K5)
4. Analyze the obtained results and prepare a technical report(K4)
5. Publish the work in journals and apply for the patents.(K3)
6. Prepare for industrial environment and real time work(K3)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO6	2	2	2	2	3	2	2	2	2	2	3	3	3	3

SEMESTER - IV

20ECTP401 SDG NO. 4	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

PROBLEM SOLVING SKILLS – PHASE 1**COURSE OBJECTIVE:**

- Improve their quantitative ability.
- Improve their reasoning ability.
- Enhance their verbal ability through vocabulary building and grammar
- Equip with creative thinking and problem solving skills

UNIT I QUANTITATIVE ABILITY – III**6**

Compound Interest - Profit and Loss - Partnership - Percentage - Set Theory

UNIT II QUANTITATIVE ABILITY – IV**6**

True Discount - Ratio and Proportion - Simplification - Problems on H.C.F and L.C.M

UNIT III REASONING ABILITY – II**6**

Course of Action - Cause and Effect - Statement and Conclusion - Statement and Argument - Data Sufficiency (DS) - Statement and Assumption - Making Assumptions.

UNIT IV VERBAL ABILITY – II**6**

Change of Voice - Change of Speech - Letter and Symbol Series - Essential Part - Verbal Reasoning - Analyzing Arguments.

UNIT V CREATIVITY ABILITY – II**6**

Seating Arrangement - Direction Sense Test - Character Puzzles - Missing Letters Puzzles - Mirror & Water Images.

TOTAL : 30 PERIODS**REFERENCES:**

- 1) R. S. Agarwal, "Quantitative Aptitude for Competitive Exams"
- 2) Sarvesh Verma, "Quantum CAT"
- 3) R. S. Agarwal, "A Modern Approach to Logical Reasoning"
- 4) Arun sharma, "Verbal Ability and Reading Comprehension"

**ADVANCED C PROGRAMMING AND MATLAB AND SIMULINK
PROGRAMMING - PHASE 2**

COURSE OBJECTIVE:

- To improve C programming skills with understanding of code organization and functional hierarchical decomposition with using complex data types.
- To understand procedural programming methods using MATLAB & SIMULINK.

UNIT I INTRODUCTION TO RECURSION AND GROWTH FUNCTIONS 6

Introduction to Recursion - Recurrence Relation - Deriving time complexity and space complexity using recurrence relation Polynomial Equations - Compare growth functions - Nth Fibonacci Number - Exponent Function - Taylor Series - Tower of Hanoi.

UNIT II STORAGE CLASSES, THE PREPROCESSOR AND DYNAMIC MEMORY ALLOCATION**6**

Storage Classes and Visibility - Automatic or local variables - Global variables - Macro Definition and Substitution - Conditional Compilation - Dynamic Memory Allocation - Allocating Memory with malloc and calloc Allocating Memory with calloc - Freeing Memory - The Concept of linked list - Inserting a node by using Recursive Programs - Deleting the Specified Node in a Singly Linked List.

UNIT III FILE MANAGEMENT AND BIT MANIPULATION**6**

Defining and Opening a file - Closing Files - Input/output Operations on Files - Predefined Streams - Error Handling during I/O Operations - Random Access to Files - Command Line Arguments - The hexadecimal number system - C bitwise operators - How to generate all the possible subsets of a set - Tricks with Bits - Applications of bit operations.

UNIT IV BASICS OF PROGRAMMING IN MATLAB**6**

Variables - array - matrices - programming structure- Script files- Functions - Debugging programs - Loops, branches and control flow - Relational and logical operations - 2D and 3D graphics - Multiple plots, Plot properties- Numerical analysis: Non-linear equations and optimization - Differential equations.

UNIT V SIMULINK AND MATLAB OPTIMIZATION TOOLBOX**6**

Introduction SIMULINK models - blocks - Systems and sub-systems - Simulating Dynamic System - Solving a model - Solvers - MATLAB SIMULINK for signal processing - Solving linear and quadratic optimization problems.

TOTAL : 30 PERIODS**REFERENCES:**

1. R. G. Dromey, "How to Solve It By Computer", Pearson, 1982
2. A.R. Bradley, "Programming for Engineers", Springer, 2011
3. Kernighan and Ritchie, "The C Programming Language", (2nd ed.) Prentice Hall, 1988
4. Amos Gilat, "Matlab, An Introduction With Applications", Wiley Publication, 4th edition
5. Brian R. Hunt, Jonathan Rosenberg, and Ronald L Lipsman, "A Guide to MATLAB", Cambridge University press.

REFERENCES

1. Agam Kumar Tyagi, "Matlab and Simulink for Engineering" Oxford Higher Education

- Rudra Pratap "Getting Started with MATLAB" Oxford Higher Education
- Stephen J Chapman, "MATLAB Programming for Engineers", 6E, CENGAGE

ONLINE RESOURCES

- <https://matlabacademy.mathworks.com/>
- <https://www.tutorialspoint.com/matlab/index.htm>
- <https://medium.com/quick-code/top-tutorials-to-learn-matlab-for-beginners-d19549ecb7b7>
- <https://nptel.ac.in/courses/103/106/103106118/>

WEB RESOURCES

- <https://www.mathworks.com/academia/books.html>
- <https://in.mathworks.com/support/learn-with-matlab-tutorials.html>

COURSE OUTCOMES :

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

- Analyze their quantitative ability. (K4)
- Understand the ability of arithmetic reasoning along with creative thinking and problem solving skills. (K2)
- Create their verbal ability through vocabulary building and grammar. (K6)
- Evaluate code organization and functional hierarchical decomposition with complex data types. (K5)
- Understand to improve C programming skills to apply advance structured and procedural programming. (K2)
- Apply the Matlab Simulink and optimization toolbox for signal processing applications. (K3)

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
C01	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C02	-	-	-	-	3	2	-	3	2	3	-	2	-	-
C03	-	-	-	-	3	2	-	-	1	3	-	2	-	-
C04	-	-	-	-	3	2	-	3	3	3	-	2	2	2
C05	-	-	-	-	3	2	-	-	2	3	-	2	2	2
C06	-	-	-	-	3	2	-	-	2	3	-	2	2	2

Imagine the Future and Make it happen!



1 NO POVERTY



2 ZERO HUNGER



3 GOOD HEALTH AND WELL-BEING



4 QUALITY EDUCATION



5 GENDER EQUALITY



6 CLEAN WATER AND SANITATION



7 AFFORDABLE AND CLEAN ENERGY



8 DECENT WORK AND ECONOMIC GROWTH



9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



10 REDUCED INEQUALITIES



11 SUSTAINABLE CITIES AND COMMUNITIES



12 RESPONSIBLE CONSUMPTION AND PRODUCTION



13 CLIMATE ACTION



14 LIFE BELOW WATER



15 LIFE ON LAND



16 PEACE, JUSTICE AND STRONG INSTITUTIONS



17 PARTNERSHIPS FOR THE GOALS



Together let's build a better world where there is **NO POVERTY** and **ZERO HUNGER**.

We have **GOOD HEALTH AND WELL BEING**, **QUALITY EDUCATION** and full **GENDER EQUALITY** everywhere.

There is **CLEAN WATER AND SANITATION** for everyone. **AFFORDABLE AND CLEAN ENERGY** which will help to create **DECENT WORK AND ECONOMIC GROWTH**. Our prosperity shall be fuelled by investments in **INDUSTRY, INNOVATION AND INFRASTRUCTURE** that will help us to **REDUCE INEQUALITIES** by all means. We will live in **SUSTAINABLE CITIES AND COMMUNITIES**.

RESPONSIBLE CONSUMPTION AND PRODUCTION will help in healing our planet.

CLIMATE ACTION will reduce global warming and we will have abundant,

flourishing **LIFE BELOW WATER**, rich and diverse **LIFE ON LAND**.

We will enjoy **PEACE AND JUSTICE** through **STRONG INSTITUTIONS**

and will build long term **PARTNERSHIPS FOR THE GOALS**.



For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **People like you.**

Together we can...

Sai Prakash Leo Muthu

CEO - Sairam Institutions

We build a Better nation
through Quality education.



Sri

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