Curriculum and Syllabi – R 2021-UG
CHOICE BASED CREDIT SYSTEM AND OBE

B.E – Electronics and Communication Engineering

Department Vision
To develop Electronics and Communication Engineers by permeating with proficient morals, to be recognized as an adroit engineer worldwide and to strive endlessly for excellence to meet the confronts of our modern society by equipping them with changing technologies, professionalism, creativity research, employability, analytical, practical skills and to excel as a successful

Department Mission
1. To provide excellence through effective and qualitative teaching-learning process that equips the students with adequate knowledge and to transform the students' lives by nurturing the human values to serve as a precious resource for Electronics and Communication Engineering and nation.
2. To enhance the problem solving and lifelong learning skills that will enable by edifying the students to pursue higher studies and career in research.
3. To create students with effective communication skills, the abilities to lead ethical values in order to fulfill the social needs.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1   **Acquiring Quality Education:** To acquire adequate and quality education on all aspects of Engineering and inculcate a spirit of lifelong learning which would spark an interest for Higher studies and Cutting-Edge research.

PEO 2   **Developing Multi-skills & Professionalism:** To develop dynamic Leadership skills, powerful Discerning & Decision making and communication skills with amicable team spirit and ethical responsibility.

PEO 3   **Contemporary learning:** To get equipped with skills in trending technologies in industries, which delivers excellent job prospects and kindles the spirit of entrepreneurship.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO_1   Design, Implement and Test Embedded and VLSI systems using state of the art components and software tools

PSO_2   Design and develop the signal processing and communication systems for the real time application.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO_a   **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO_b   **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO_c   **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO_d   **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO_e   **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO_f   **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO_g   **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO_h   **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO_i   **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO_j   **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations,

and give and receive clear instructions.

PO$_k$ **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO$_l$ **Life-Long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Mapping with PO's Vs PEO's, PSO's

PO	PEO1	PEO2	PEO3	PSO1	PSO2
1	3		2	3	1
2	1	2	2	2	1
3	1	2	2	2	2
4	2	2	2	3	2
5	1		2		3
6		2	2		
7	1	2	2		1
8		2			
9		3	2		2
10		3	2		1
11	2	3	2	1	1
12	2	2	2	2	2

B.E ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION

SUMMARY OF CREDIT DISTRIBUTION

S. No	Category	Credits Per Semester								Total Credit	Credits in %
		I	II	III	IV	V	VI	VII	VIII		
1	**HSSM**	3	2			6				**11**	**6.62%**
2	**BS**	12	4	4						**20**	**12.04%**
3	**ES**	9	8	5						**22**	**13.25%**
4	**PC**		5	13	18	12	9	10		**67**	**40.36%**
5	**PE**					3	6	9		**18**	**10.84%**
6	**OE**					3	6	3		**12**	**7.22%**
7	**EEC**			1	1	1	3		10	**16**	**9.63%**
	Total	**24**	**19**	**23**	**19**	**25**	**24**	**22**	**10**	**166**	**100%**

HSSM – Humanities and Social Sciences including Management
BS – Basic Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Elective
OE – Open Elective/ Programme Specific Elective for Expandable Scope
EEC – Employability Enhancement Courses

B.E ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS 2021
Choice Based Credit System and Outcome Based Education
I – VIII Semester Curriculum and Syllabi
SEMESTER I

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MA1201	Matrices and Advanced Calculus	BS	4	3	1	0	4
2	21PH1301	Physics for Engineers	BS	3	3	0	0	3
3	21CY1401	Engineering Chemistry	BS	3	3	0	0	3
4	21CS1501	Problem Solving and Logical Thinking using C	ES	3	2	1	0	3
Theory cum Practical Courses								
1	21HS1101	English for Professional Communication	HSSM	4	2	0	2	3
2	21ME1513	Computer Aided Engineering Graphics	ES	5	3	0	2	4
Practical Courses								
1	21PY1311	Physics and Chemistry Laboratory	BS	4	0	0	4	2
2	21CS1511	Programming Practice Laboratory using C	ES	4	0	0	4	2
			Total	30	16	2	12	**24**

SEMESTER II

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21HS2101	English for Technical Communication	HSSM	2	2	0	0	2
2	21MA2201	Partial Differential Equation and Application of Fourier Series	BS	4	3	1	0	4
3	21EC2601	Semiconductor Devices and Circuits	PC	3	3	0	0	3
Theory cum Practical Courses								
1	21EC1503	Fundamentals of Electrical, Electronics and Communication	ES	5	3	0	2	4
2	21CS2501	Introduction to Computing using Python	ES	5	3	0	2	4
Practical Courses								
1	21EC2611	Semiconductor Devices and Circuits Laboratory	PC	4	0	0	4	2
			Total	23	14	1	08	**19**

SEMESTER III

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MA3203	Probability and Numerical Techniques	BS	4	3	1	0	4
2	21EC3501	Object Oriented Programming and Data Structures	ES	3	3	0	0	3
3	21EC3601	Analog Electronics	PC	3	3	0	0	3
4	21EC3602	Signals and Systems	PC	4	3	1	0	4
Theory cum Practical Courses								
1	21EC3603	Digital Logic Design	PC	5	3	0	2	4
Practical Courses								
1	21EC3511	Object Oriented Programming and Data Structures Laboratory	ES	4	0	0	4	2
2	21EC3611	Analog Electronics Laboratory	PC	4	0	0	4	2
3	21PT3901	Aptitude I	EEC	2	1	0	0	1
			Total	29	16	2	10	**23**

SEMESTER IV

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21EC4601	Analog and Digital Communication	PC	3	3	0	0	3
2	21EC4602	Applied Electromagnetics	PC	3	3	0	0	3
3	21EC4604	Principles of Computer Networks	PC	3	3	0	0	3
4	21EC4605	Control Systems	PC	3	3	0	0	3
Mandatory Course								
1	21GE2M02	Environmental and Sustainable Engineering	MC	2	2	0	0	0
Theory cum Practical Courses								
1	21EC4603	Linear Integrated Circuits	PC	5	3	0	2	4
Practical Courses								
1	21EC4611	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
2	21PT3902	Verbal Ability	EEC	2	1	0	0	1
			Total	25	18	0	6	**19**

SEMESTER V

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MG5101	Total Quality Management	HSSM	3	3	0	0	3
2	21HS3101	Ethics and Values	HSSM	3	3	0	0	3
3	21EC5601	Microprocessor and Microcontroller	PC	3	3	0	0	3
4	21EC5602	Wireless Communication Systems	PC	3	3	0	0	3
5		Professional Elective – I	PE	3	3	0	0	3
6		Open Elective I	OE	3	3	0	0	3
Theory cum Practical Courses								
1	21EC5603	Discrete Time Signal Processing	PC	5	3	0	2	4
Practical Courses								
1	21EC5611	Microprocessor and Microcontroller Laboratory	PC	4	0	0	4	2
2		Aptitude - II	EEC	2	1	0	0	1
			Total	29	22	0	6	**25**

SEMESTER VI

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21EC6601	VLSI Design	PC	3	3	0	0	3
2		Professional Elective – II	PE	3	3	0	0	3
3		Professional Elective – III	PE	3	3	0	0	3
4		Open Elective – II	OE	3	3	0	0	3
5		Open Elective – III	OE	3	3	0	0	3
Theory cum Practical Courses								
1	21EC6602	Transmission lines and Radiation Systems	PC	5	3	0	2	4
Mandatory Course								
1	21GE2M01	Indian Constitution and Cultural Heritage	MC	2	2	0	0	0
Practical Courses								
1	21EC5611	VLSI Design Laboratory	PC	4	0	0	4	2
2		Reasoning	EEC	2	1	0	0	1
3	21EC6911	Project Work - I/Internship	EEC	4	0	0	4	2
			Total	32	21	0	10	**24**

SEMESTER VII

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21EC7601	Microwave and Optical Communication	PC	3	3	0	0	3
2	21EC7602	Embedded and IoT	PC	3	3	0	0	3
3		Professional Elective - IV	PE	3	3	0	0	3
4		Professional Elective - V	PE	3	3	0	0	3
5		Professional Elective - VI	PE	3	3	0	0	3
6		Open Elective IV	OE	3	3	0	0	3
Practical Courses								
1	21EC7611	Advanced Communication Laboratory	PC	4	0	0	4	2
2	21EC7612	Embedded and IoT Laboratory	PC	4	0	0	4	2
			Total	26	18	0	8	**22**

SEMESTER VIII

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Practical Courses								
1	21EC8911	Project Work – II/Startup	EEC	20	0	0	20	10
			Total	20	0	0	20	**10**

TOTAL NO. OF CREDITS: 166(Regular) / 123(Lateral)

Humanities and Social Sciences Including Management (HSSM)

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21HS2101	English for Technical Communication	HSSM	2	2	0	0	2
2	21HS3101	Ethics and Values	HSSM	3	3	0	0	3
3	21MG5101	Total Quality Management	HSSM	3	3	0	0	3
Theory cum Practical Courses								
1	21HS1101	English for Professional Communication	HSSM	4	2	0	2	3

List of Basic Science Courses

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MA1201	Matrices and Advanced Calculus	BS	4	3	1	0	4
2	21PH1301	Physics for Engineers	BS	3	3	0	0	3
3	21CY1401	Engineering Chemistry	BS	3	3	0	0	3
4	21MA2201	Partial Differential Equation and Application of Fourier Series	BS	4	3	1	0	4
5	21MA3201	Probability and Numerical Techniques	BS	4	3	1	0	4
Practical Courses								
1	21PY1311	Physics and Chemistry Laboratory	BS	4	0	0	4	2

List of Engineering Science Courses

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21CS1501	Problem Solving and Logical Thinking using C	ES	3	2	1	0	3
2	21EC3501	Object Oriented Programming and Data Structures	ES	3	3	0	0	3
Theory cum Practical Courses								
1	21EC1503	Fundamentals of Electrical, Electronics and Communication	ES	5	3	0	2	4
2	21ME1513	Computer Aided Engineering Graphics	ES	5	3	0	2	4
3	21CS2501	Introduction to Computing using Python	ES	5	3	0	2	4
Practical Courses								
1	21CS1511	Programming Practice Laboratory using C	ES	4	0	0	4	2

2	21EC3511	Object Oriented Programming and Data Structures Laboratory	ES	4	0	0	4	2

List of Professional Core Courses

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21EC2601	Semiconductor Devices and Circuits	PC	3	3	0	0	3
2	21EC3601	Analog Electronics	PC	3	3	0	0	3
3	21EC3602	Signals and Systems	PC	3	3	1	0	4
4	21EC4601	Analog and Digital Communication	PC	3	3	0	0	3
5	21EC4602	Applied Electromagnetics	PC	3	3	0	0	3
6	21EC4604	Principles of Computer Networks	PC	3	3	0	0	3
7	21EC4605	Control Systems	PC	3	3	0	0	3
8	21EC5601	Microprocessor and Microcontroller	PC	3	3	0	0	3
9	21EC5602	Wireless Communication Systems	PC	3	3	0	0	3
10	21EC6601	VLSI Design	PC	3	3	0	0	3
11	21EC7601	Microwave and Optical Communication	PC	3	3	0	0	3
12	21EC7602	Embedded and IoT	PC	3	3	0	0	3
Theory cum Practical Courses								
1	21EC3603	Digital Logic Design	PC	5	3	0	2	4
2	21EC4603	Linear Integrated Circuits	PC	5	3	0	2	4
3	21EC5603	Discrete Time Signal Processing	PC	5	3	0	2	4
4	21EC6602	Transmission lines and Radiation Systems	PC	5	3	0	2	4
Practical Courses								
1	21EC2611	Semiconductor Devices and Circuits Laboratory	PC	4	0	0	4	2
2	21EC3611	Analog Electronics Laboratory	PC	4	0	0	4	2
3	21EC4611	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
4	21EC5611	Microprocessor and Microcontroller Laboratory	PC	4	0	0	4	2
5	21EC5611	VLSI Design Laboratory	PC	4	0	0	4	2
6	21EC7611	Advanced Communication Laboratory	PC	4	0	0	4	2
7	21EC7612	Embedded and IoT Laboratory	PC	4	0	0	4	2

List of Employability Enhancement Courses

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Practical Courses								
1	21PT3901	Aptitude I	EEC	2	1	0	0	1
2	21PT3902	Verbal Ability	EEC	2	1	0	0	1

3		Aptitude II	EEC	2	1	0	0	1
4		Reasoning	EEC	2	1	0	0	1
5	21EC6911	Project Work - I/ Internship	EEC	4	0	0	4	2
6	21EC8911	Project Work – II/ Startup	EEC	20	0	0	20	10

List of Mandatory Courses

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Practical Courses								
1	21GE2M01	Indian Constitution and Cultural Heritage	MC	2	2	0	0	0
2	21GE2M02	Environmental and Sustainable Engineering	MC	2	2	0	0	0

List of Professional Electives Courses

S.No	Course Code	Course Name	Sem.	L	T	P	C	Stream/Domain
Professional Elective I								
1	21EC5701	Medical Electronics	5	3	0	0	3	Electronics
2	21EC5702	Information Theory and Coding Techniques	5	3	0	0	3	Communication
3	21EC5703	Computer Architecture and Organization	5	3	0	0	3	Embedded
4	21EC5704	Wireless Networks	5	3	0	0	3	Networks
5	21EC5705	Robotics and Artificial Intelligence	5	3	0	0	3	Robotics
6	21EC5706	VLSI Signal Processing	5	3	0	0	3	VLSI
Professional Elective II								
1	21EC6701	Solid State Devices	6	3	0	0	3	Electronics
2	21EC6702	Satellite Communication and Broadcasting	6	3	0	0	3	Communication
3	21EC6703	Advanced Microprocessors and Microcontrollers	6	3	0	0	3	Embedded
4	21EC6704	Cryptography and Network Security	6	3	0	0	3	Networks
5	21EC6705	Sensors, Actuators and Interface Electronics	6	3	0	0	3	Robotics
6	21EC6706	Mixed Signal IC Design	6	3	0	0	3	VLSI
Professional Elective III								
1	21EC6707	Nanoelectronic Devices and Circuits	6	3	0	0	3	Electronics
2	21EC6708	Multimedia Compression and Communication	6	3	0	0	3	Communication

3	21EC6709	ARM based Digital Signal Processing	6	3	0	0	3	Embedded
4	21EC6710	Blockchain Principles	6	3	0	0	3	Networks
5	21EC6711	Robotics and Automation	6	3	0	0	3	Robotics
6	21EC6712	CMOS Analog IC Design	6	3	0	0	3	VLSI
Professional Elective IV								
1	21EC7701	Design and Fabrication of Electronic Product	7	3	0	0	3	Electronics
2	21EC7702	Broadband Access Technologies	7	3	0	0	3	Communication
3	21EC7703	IoT System Design and Applications	7	3	0	0	3	Embedded
4	21EC7704	Ad hoc and Wireless Sensor Networks	7	3	0	0	3	Networks
5	21EC7705	Deep Learning Techniques for computer vision	7	3	0	0	3	Robotics
6	21EC7706	Lowpower SOC	7	3	0	0	3	VLSI
Professional Elective V								
1	21EC7707	Micro- and Nano-Fabrication Technologies	7	3	0	0	3	Electronics
2	21EC7708	Mobile Communications	7	3	0	0	3	Communication
3	21EC7709	Embedded C and Linux	7	3	0	0	3	Embedded
4	21EC7710	Cognitive Radio Networks	7	3	0	0	3	Networks
5	21EC7711	Unmanned Aerial Vehicles	7	3	0	0	3	Robotics
6	21EC7712	ASIC and FPGA Based Design	7	3	0	0	3	VLSI
Professional Elective VI								
1	21EC7713	Digital Image Processing	7	3	0	0	3	Electronics
2	21EC7714	Millimeter wave Communication	7	3	0	0	3	Communication
3	21EC7715	Design using RaspBerry Pi	7	3	0	0	3	Embedded
4	21EC7716	4G & 5G Networks	7	3	0	0	3	Networks
5	21EC7717	Machine Learning Fundamentals	7	3	0	0	3	Robotics
6	21EC7718	CAD for VLSI Circuits	7	3	0	0	3	VLSI

SEMESTER I

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MA1201	Matrices and Advanced Calculus	BS	4	3	1	0	4
2	21PH1301	Physics for Engineers	BS	3	3	0	0	3
3	21CY1401	Engineering Chemistry	BS	3	3	0	0	3
4	21CS1501	Problem Solving and Logical Thinking using C	ES	3	2	1	0	3
Theory cum Practical Courses								
1	21HS1101	English for Professional Communication	HSSM	4	2	0	2	3
2	21ME1513	Computer Aided Engineering Graphics	ES	5	3	0	2	4
Practical Courses								
1	21PY1311	Physics and Chemistry Laboratory	BS	4	0	0	4	2
2	21CS1511	Programming Practice Laboratory using C	ES	4	0	0	4	2
			Total	30	16	2	12	**24**

21MA1201	MATRICES AND ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

Preamble:

The course consists of topics in Matrices, Differential calculus, Integral calculus, Differential Equations and Vector calculus with applications to various engineering problems. This course will cover the following main topics: Cayley Hamilton Theorem, Linear differential equations of second order with constant coefficients, Methods of Variation parameter, Taylor's expansion of two variables, Maxima and Minima for two variables, Area and Volume in a multiple integrals, Green's theorem and Gauss divergence theorem.

Prerequisites for the course:

Students should have basic knowledge about matrices, differentiation and integration

Objectives

1. To apply advanced matrix knowledge to Engineering problems
2. To familiarize with the applications of differential equations.
3. To familiarize with the functions of several variables
4. To have Knowledge in Multiple integrals
5. To improve their ability in Vector calculus.

UNIT I	MATRICES	9+3

Matrices - Characteristic equation – Eigen values and Eigen vectors of a symmetric and non symmetric matrix – Properties of Eigen values and Eigen vector – Cayley – Hamilton theorem and its applications

SUGGESTED EVALUATION METHODS:

- Tutorial Problems on Eigen values , Eigen Vectors and Cayley Hamilton Theorem and Add MATLAB and for application Add Power method to find Eigen value & Eigen vector

UNIT II	ORDINARY DIFFERENTIAL EQUATIONS	9+3

Differential Equations – Complementary Function – Particular Integral - Linear equations of

second order with constant coefficients of types exponential, trigonometry, polynomial and its combination forms - Methods of Variation of parameter - Engineering Applications.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Linear differential equations of different types and Method of Variation parameters.

UNIT III	FUNCTIONS OF SEVERAL VARIABLES	9+3

Function of two variables – Partial derivatives – Taylor's expansion for two variables – Maxima and Minima for two variables – Jacobians of two and three variables – Euler's theorem for homogeneous function.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Taylor's series, Jacobians, Maxima and Minima for two variables

UNIT IV	MULTIPLE INTEGRALS	9+3

Definite Integrals – Properties of definite integrals - Double integration in Cartesian coordinates – Area as a double integral in Cartesian coordinates – Triple integration in Cartesian coordinates – Volume as a Triple Integral

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Area , Triple integration and Volume

UNIT V	VECTOR CALCULUS	9+3

Vector dot product and Vector cross product - Gradient, divergence, curl – Solenoidal and irrotational fields –Unit normal vector - Angle between two surfaces - Directional derivatives – Green's theorem, Gauss divergence theorem (without proof) – Engineering Applications.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Angle between two surfaces, Green's theorem, Gauss divergence theorem.

	Total Periods	45 + 15 = 60 Periods

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
1. Descriptive Questions	1.Assignment 2. Online Quizzes	1. Descriptive Questions

Outcomes

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

CO1: Find the eigen values, eigen vectors, inverse and the positive powers of a square matrix
(Apply)

CO2:   Identify the suitable method to solve second and higher order differential equations
(Apply)

CO3: Find the maxima and minima for a given function with several variables, through by finding stationary points

(Apply)

CO4: Compute area and volume using double and triple integration.   (Apply)

CO5: Apply the concepts of Differentiation and Integration to Vectors.   (Apply)

Text Books
1. B. S. Grewal, " Higher Engineering Mathematics", 43rd edition, 2017.
2. James Stewart, Calculus – Early Transcendals, 8th Edition, 2016.

Reference Books
1. A Textbook of Engineering Mathematics(Dr. A.P.J. Abdul Kalam Technical University, Lucknow)   (For . Gautam Bhudh technical Universities ,Lucknow) January 2020
2. K. Ganesan, Sundarammal Kesavan, K. S. Ganapathy Subramanian & V. Srinivasan,

"Calculus and Solid Geometry", Revised Edition, 2017

Web Resources

1. Eigen values and eigen vectors - https://youtu.be/h5urBuE4Xh
   Cayley Hamilton theorem -https://youtu.be/WROFJ15hk00
2. ODE - https://youtu.be/Im242eBqaxw
3. Functions of several variables -https://youtu.be/PA82F91e1vs
4. Integration - https://youtu.be/bVui07yHjzE,
   Multiple integrals -https://youtu.be/3BbrC9JcjOU
   Volume as Triple integral - https://youtu.be/w_KiHgultbM
5. Vector calculus - https://youtu.be/v3ZC4Mo1fS0i
   Gauss divergence theorem https://youtu.be/U9LDcmKUGS0

CO Vs PO Mapping and CO Vs PSO Mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
1	3	2												
2	3	2												
3	3	2												
4	3	2												
5	3	2												

BLOOOMS LEVEL ASSESSMENT PATTERN

BLOOM'S CATEGORY	ASSESSMENT TESTS				END SEMESTER EXAMINATION
	CAT – 1	CAT -2	FAT - 1	FAT - 2	
REMEMBER	10	10	5	5	10
UNDERSTAND	30	30	10	10	30
APPLY	60	60	10	10	60
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1 (CO 1) : (Apply)

1) Compute the eigen values and eigen vectors for the Symmetric matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$

2) Find A^{-1} and A^4 using Cayley Hamilton Theorem for the matrix $A = \begin{bmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{bmatrix}$.

COURSE OUTCOME 2 (CO 2) : (Apply)

1) Solve $(D^2 - D + 1)y = \sin 2x + e^{-4x}$
2) Solve $(D^2 + a^2)\, y = \tan ax$ by using method of variation of parameters.

COURSE OUTCOME 3(CO 3) : (Apply)

1. Find the extreme values of the function $f(x, y)$= x³ + y³ – 12x -3y +20.
2. Calculate the maxima and minima of the function $f(x, y) = x^3 y^2$ (1-x-y).

COURSE OUTCOME 4(CO 4) : (Apply)

1)Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

2) Find $\int_0^a \int_0^b \int_0^c xyz \, dz \, dy \, dx$

COURSE OUTCOME 5(CO 5) : (Apply)

1. Find the directional derivative of $\emptyset = xy^2 + yz^3$ at the point (2,-1,1) in the direction of $\vec{i} + 2\vec{j} + 2\vec{k}$.

2. Using Green's theorem , find $\int_c (x^2 - y^2)dx + 2xydy$ where C is the boundary of the rectangle in the XOY-plane bounded by the lines $x = 0, x = a, y = 0, y = b$.

3. Verify Gauss divergence theorem for $\vec{F} = 4xz\vec{i} - y^2\vec{j} + yz\vec{k}$ over the cube bounded by $x = 0, x = 1, y = 0, y = 1, z = 0$ and $z = 1$.

21PH1301	PHYSICS FOR ENGINEERS (Common to AI&DS, CSE, CSBS, IT, ECE & EEE)	L	T	P	C
		3	0	0	3

Preamble

This course aims in imparting fundamental knowledge in materials which are essential in understanding and explaining engineering devices.

Prerequisites for the course

Basic theoretical concepts of Physics in XI and XII.

Objectives

1. To impart knowledge about electrical properties of materials.
2. To acquire knowledge about Semiconductor Physics.
3. To enable the students to gain knowledge on magnetic properties.
4. To elucidate the optical properties under the concepts of optical devices.
5. To motivate the students towards the application of nanomaterials.

UNIT I	ELECTRICAL PROPERTIES OF MATERIALS	9

Classical free electron theory – Expression for electrical conductivity – Thermal conductivity– Wiedemann -Franz law –Merits and Demerits – Quantum theory - Fermi- Dirac statistics – Density of energy states.

UNIT II	SEMICONDUCTOR PHYSICS	9

Intrinsic Semiconductors – Energy band diagram – direct and indirect semiconductors – Carrier concentration in intrinsic semiconductors –Extrinsic semiconductors – N-type & P-type semiconductors – variation of Fermi level with temperature and impurity concentration – Hall effect and devices.

UNIT III	MAGNETIC PROPERTIES OF MATERIALS	9

Magnetism in materials – magnetic field and induction – magnetization – magnetic permeability and susceptibility– Classification of Magnetic materials– Domain Theory - M versus H behavior - Hard and Soft magnetic materials–examples and uses–Magnetic Principle in computer data storage - Magnetic Resonance Imaging.

UNIT IV	OPTICAL PROPERTIES OF MATERIALS	9

Classification of Optical Materials–carrier generation and recombination processes–Absorption, Emission and Scattering of light in metals, Insulators and Semiconductors – Solar cell–LED–Organic LED–Laser Diodes– Optical Data Storage Techniques.

UNIT V	NANO DEVICES	9

Quantum Confinement Quantum structures – Density of states in quantum well, quantum wire and quantum dot structure –Band gap of nanomaterials –Tunneling: Single electron phenomena and single electron transistor- Quantum dot Laser- Carbon Nanotubes - Properties and Applications.

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
Descriptive	1. Assignment 2. Online Quizzes 3. Problem-Solving Activities	Descriptive

Outcomes

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

CO 1	Expound the basics of classical and quantum electron theories. **Understand**
CO 2	Acquire knowledge on basic semiconductor physics and its application in various devices. **Understand**
CO 3	Identify the properties of magnetic materials and their applications in data storage. **Understand**
CO 4	Understand the functions of optical materials for Optoelectronics. **Understand**
CO 5	Interpret quantum theory concepts & study the density of states for various Quantum Confinements. **Apply**

Text Books

1. Dr. P. Mani,"Physics for Information Science",SreeDhanam Publisher, 2017
2. Senthilkumar G, Murugavel S, "Physics for Information Science",VRB Publication, 2017-2018

Reference Books

1. Srinivasan.P, "Physics for Electronics Engineering". Vishnu Prints Media, 1st edition Jan 2018
2. Kasap, S.O., Principle of Electronic Materials and devices, Tata Mc-Graw Hill Education, 20 th reprint 2019.
3. Halliday, D., Resnick, R. & Walker, J. ―Principles of Physics‖. Wiley, 2015.
4. S. Salivahanan,A. Rajalakshmi"Physics for Electronics Engineering and Information Science" - Tata Mc-Graw Hill Education,29 January 2018.

Web Resources

1. UNIT 1 -https://www.britannica.com/science/Fermi-Dirac-statistics
2. UNIT 2- http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1
3. UNIT 3- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4934330/
4. UNIT 4- http://www.explainthatstuff.com/how-oleds-and-leps-work.html
5. UNIT 1 TO 5- https://easyengineering.net/ph8253-physics-for-electronics-engineering/

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	2	2					1					1		
2	2	2					1					1		
3	2	2					1					1		
4	2	2					1					1		
5	2	2	1				1					1		

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	10	10	10	10	10
UNDERSTAND	50	50	20	20	40
APPLY	40	40	20	20	50
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0
	100	**100**	**50**	**50**	**100**

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: Expound the basics of classical and quantum electron theories. (Understand)
1. The thermal conductivity of copper at 300 K is 470.4 $Wm^{-1}K^{-1}$. Calculate the electrical conductivity of copper at 300 K. (Lorentz number = 2.45×10^{-8})
2. On the basis of classical free electron theory derive an expression for the electrical conductivity.
3. Explain fermi dirac distribution for electrons in a metal and discuss the effect of temperature on fermi function.

COURSE OUTCOME 2: Acquire knowledge on basic semiconductor physics and its application in various devices. (Understand)
1. Derive an expression for the number of electrons in the conduction band of an intrinsic semiconductor.
2. Show that for a n-type semiconductor the hall Coefficient is given by $RH = +\frac{1}{ne}$. Describe an experimental setup to measure the Hall voltage.

COURSE OUTCOME 3: Identify the properties of magnetic materials and their applications in data storage. (Understand)
1. Distinguish between dia, para,ferro,antiferro and ferrimagnetic materials
2. Write short notes on magnetic recording materials and discuss any one in detail.

COURSE OUTCOME 4: Understand the functions of optical materials for Optoelectronics. (Understand)
1. An LED emits green light of wavelength (λ) = 5511.11 A^0. Find out the value of E_g.
2. Explain the theory and working of LEDs. What are the different types of LED? Explain the advantages.

3. Explain the construction and working of solar cells.
    COURSE OUTCOME 5: Interpret quantum theory concepts & study the density of states for various Quantum confinements. (Apply)
1. Using the concept of DOS (Density of State) expound the different quantum confinements.
2. Using the single electron transistor interrupts the phenomena of a single electron.
3. Show the variation using the density of states in nanostructures for different dimensions.

21CY1401	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

Preamble
To enable the students to acquire knowledge in the concepts of chemistry for engineering applications and to familiarize the students with different application oriented topics like electrochemistry, corrosion prevention methods, significance of alloys, benefits of renewable energy sources, engineering materials, desalination etc., which enable them to develop abilities and skills that are relevant to the study and practice of engineering chemistry.

Prerequisites for the course
    Basic theoretical concepts of Chemistry in higher secondary level.

Objectives
1. To inculcate sound understanding of water quality parameters and water treatment techniques.
2.   To make the students familiar with the principles of electrochemistry and corrosion.
3. To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
4. To have a thorough understanding on the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills, fuel cells and supercapacitors .
5. To make the students learn the basics of polymer chemistry, composites and nanomaterials.

UNIT I	WATER AND ITS TREATMENT	9

Hardness of water – Types – Expression of hardness – Units – Estimation of hardness of water by EDTA –Municipal water treatment- Boiler troubles (scale and sludge) – Treatment of boiler feed water – Internal treatment (phosphate and calgon conditioning)-External treatment – Ion exchange process- Desalination of brackish water - Reverse Osmosis.

UNIT II	ELECTROCHEMISTRY AND CORROSION	9

Electrodes- types, Cells- types, Construction (Daniel cell) - Electrode potential- Measurement of Single electrode potential – Nernst equation and its applications- Emf series & its applications. Corrosion- Causes- Types- Chemical, Electrochemical corrosion (galvanic, differential aeration), Corrosion control – Material selection and design aspects – Electrochemical protection – Sacrificial Anode cathodic Protection method.

UNIT III	PHASE RULE AND ALLOYS	9

Phase rule: Introduction, definition of terms with examples, One component system -Water system - Reduced Phase rule - Two component systems - Lead-Silver system – Pattinson's process.
Alloys: Introduction- Properties of alloys- Significance of alloying, Nichrome and Stainless steel (18/8) – Heat treatment of steel.

UNIT IV	ENERGY SOURCES AND STORAGE DEVICES	9

Nuclear fission - Nuclear fusion - Differences between nuclear fission and fusion - Nuclear chain reactions - Nuclear energy - Light Water Nuclear Power Plant - Solar energy conversion - Solar cells - Wind energy.

Batteries & Fuel cells: Types of batteries – Primary battery (dry cell) Secondary battery (lead acid battery, lithium-ion-battery) Fuel cells – H_2-O_2 fuel cell and microbial fuel cell; Supercapacitors: Storage principle, types and examples.

UNIT V	ENGINEERING MATERIALS	9

Polymers: Classification of Polymers – Properties of Polymers: Tg, Tacticity. Preparation, properties and uses of Teflon and Nylon 6,6. Composites: Introduction: Definition & Need for composites; Properties and applications of Polymer matrix composites and hybrid composites. Nanomaterials: Types of nanomaterials; properties and uses of nanoparticle, nanocluster, nano rod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, chemical vapour deposition and electrochemical deposition methods. Applications of nanomaterials in medicine, agriculture, energy and electronics.

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
WRITTEN TEST	ASSIGNMENT & ONLINE QUIZZES	WRITTEN TEST

Outcomes

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

1	Infer the quality of water parameters from quality parameter data and propose suitable methodologies to treat water. (Remember)
2	Identify and apply the basic principles of electrochemistry and corrosion. (Understand)
3	Identify suitable alloys for material analysis. (Remember)
4	Identify different forms of energy resources and apply them in suitable energy sectors. (Apply)
5	Recognise and apply basic knowledge on polymers and nanomaterials to futuristic material fabrication needs. (Understand)

Text Books

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2018
2. P. C. Jain and Monika Jain, "Engineering Chemistry" Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2018

Reference Books

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.

Web Resources
   1. NPTEL Course
      https://www.digimat.in/nptel/courses/video/121106014/L01.html
   2. Mod-06 Lec-36 Fundamentals of Electrochemical Techniques
      https://www.youtube.com/watch?v=l2ENx_Y0dNU

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	2				2						2		

2	2	2				2					2		
3	2	2									2		
4	2	2									2		
5	2	2									2		

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	30	30	10	10	30
UNDERSTAND	30	30	10	10	30
APPLY	20	20	5	5	20
ANALYZE	20	20	0	0	20
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0
	100	100	25	25	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: Students will be able to infer the quality of water parameters from quality parameter data and propose suitable methodologies to treat water. (Remember)

1. How is the exhausted resin regenerated in an ion exchanger?
2. Suggest your valuable ideas to protect the boiler from corrosion.

COURSE OUTCOME 2: Students will be able to identify and apply the basic principles of electrochemistry and corrosion. (Understand)

1. Compare the mechanisms involved in electrochemical cells and electrolytic cells.
2. How corrosion is prevented by sacrificial anode cathodic protection methods.

COURSE OUTCOME 3: Students will be able to identify suitable alloys for material analysis. (Remember)

1. Illustrate phase, component and degree of freedom with example
2. Will stainless steel rust? Justify.

COURSE OUTCOME 4: Students will be able to identify different forms of energy resources and apply them in suitable energy sectors. (Apply)

1. Is it safe to utilize wind energy for domestic purposes? How are commercial wind farms developed and how can I get a wind farm on my property?
2. Critically analyze nuclear power technology in terms of environmental and health safety. Draw a general layout of the Light water nuclear reactor and explain its components.

COURSE OUTCOME 5: Students will be able to recognise and apply basic knowledge on polymers and nonmaterials to futuristic material fabrication needs. (Understand)

1. What do you feel the repercussions are for extended life through utilization of nanotechnology?
2. Give an account of the preparation properties and uses of Teflon and nylon 6, 6.

21CS1501	PROBLEM SOLVING AND LOGICAL THINKING USING C	L	T	P	C
		2	1	0	3

Preamble

This course aims to provide the students with a foundation in computer programming. The focus is to develop the basic problem solving skills in students, and to improve their proficiency in applying the basic knowledge of programming to solve problems. This will enable the students to develop modular applications related to the field of engineering.

Prerequisites for the course

- NIL

Objectives

1. To learn the basic constructs of C Programming.
2. To learn arrays and strings concepts of C Programming.
3. To learn functions in C and use pointers for storing data in the main memory efficiently.
4. To learn structures and union concepts of C Programming
5. To learn file processing functions and further develop applications in C

UNIT I	INTRODUCTION TO PROBLEM SOLVING AND BASICS OF C PROGRAMMING	10

Introduction to Computer Software-Generations of programming languages- problem solving and logical thinking- Algorithm- Flowcharts - practical examples- Characteristics of C-uses of C- Structure of a 'C' program – Files used in C programs- Compiling and executing C programs - C Tokens- Character Sets in C- Keywords- Identifiers- Using comments in C

SUGGESTED ACTIVITIES

- Discussion on Logical and Algorithmic thinking
- Demonstration of concepts using Algorithms and Flowcharts

SUGGESTED EVALUATION METHODS

- Write basic programs in C based on algorithm and flowchart
- Quiz on problem solving and basics of C programming

UNIT II	DECISION CONTROL STATEMENTS AND ARRAYS	10

Data Types- Variables- Constants- Managing Input and Output operations in C- Operators and Expressions- Type Conversion- Type casting- Decision Making: Branching and Iterative statements-Nested Loops-break and continue statements- Arrays: Declaration, Initialization- Operations- One dimensional Arrays- Two Dimensional Arrays- Multidimensional Arrays.

SUGGESTED ACTIVITIES

- Demonstrate the use of data types and operators
- Comparison study on the types of decision making and looping statements
- Comparison study with examples on the types of arrays

SUGGESTED EVALUATION METHODS

- Demonstration of programs using Nested if and Nested loops
- Demonstration of programs using arrays and its operations
- Quiz on data types, operators, statements, loops and arrays

UNIT III	FUNCTIONS, STRINGS AND POINTERS	10

Functions: Declaration and prototyping- Definition- Types- Call and Return statement- Parameter passing methods- Recursion and types. Strings: String operations- Arrays of Strings –Pointers: Declaration- Definition- Pointer Arithmetic- Null pointers- Pointers and Arrays- Pointers and Functions- Pointers and Strings- Pointers to Pointers, Dynamic Memory Allocation

SUGGESTED ACTIVITIES

- Discussion on array of pointers, function pointers and array of function pointers
- Comparison study on the types of dynamic memory allocation
- Solve problems on pointers to arrays,pointers to functions and pointers to pointers

SUGGESTED EVALUATION METHODS

- Demonstration of programs using pre defined, user defined and recursive functions
- Demonstration of programs using String manipulation functions
- Quiz on basics of functions, strings and pointers

UNIT IV	STRUCTURE, UNION AND ENUMERATED DATA TYPES	8

Structure: Declaration and Initialization- Nested Structures- Array of Structures- Structures and functions- pointers to structures- Self-referential structures. Unions: Declaration and Initialization- Arrays of union variables- unions inside structures- Enumerated data types

SUGGESTED ACTIVITIES

- Discussion and comparison of Structures and Unions
- Solve problems by using nested structures and union inside structures

SUGGESTED EVALUATION METHODS

- Demonstration of programs using pointers to structures and self referential structures
- Demonstration of programs using enumerated data types and its operations

UNIT V	FILE PROCESSING AND PRE PROCESSOR DIRECTIVES	7

Introduction to Files – Using Files in C- Read data from files- Write data to files- Error Handling during file operations- Command line arguments- Random file functions- Pre processor Directives: Introduction-Types- Unconditional directives- Conditional Directives- examples

SUGGESTED ACTIVITIES

- Assignment on modes of operations using files in C
- Discussion on types of pre-processor directives

SUGGESTED EVALUATION METHODS

- Demonstration of programs using file operations
- Demonstration of programs using pre-processor directives

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)

1. DESCRIPTIVE QUESTIONS 2. PROGRAMING AND PROBLEM SOLVING QUESTIONS	1.ASSIGNMENT 2. ONLINE QUIZZES 3.PROBLEM-SOLVING ACTIVITIES	1.DESCRIPTIVE QUESTIONS 2. PROGRAMING AND PROBLEM SOLVING QUESTIONS

Course Outcomes

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

CO1 Apply algorithmic thinking to understand, define and solve problems (Apply)
CO2 Write simple programs in C using basic constructs, loops and arrays (Apply)
CO3 Use strings, functions and pointers in C to solve complex problems (Apply)
CO4 Write programs in C using structures and union to store different data (Apply)
CO5 Apply file operations and advanced features to develop real time solutions (Apply)

Text Books

1. ReemaThareja, "Programming in C",Oxford University Press, Second edition, 2016
2. Beecher K. Computational Thinking: A beginner's guide to Problem-solving and Programming. BCS Learning & Development Limited, 2017.

Reference Books

1. Byron Gottfried "Programming With C" Fourth Edition, McGrawHill, 2018.
2. Yashvant P. Kanetkar. "Let Us C", BPB Publications, 2016.

Web Resources
1. https://www.programiz.com/c-programming
2. https://nptel.ac.in/courses/106105171/
3. https://www.javatpoint.com/c-programming-language-tutorial
4. https://www.tutorialspoint.com/cprogramming/index.htm
5. https://www.w3schools.com/c/

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	10	5	5	10
UNDERSTAND	40	20	10	10	20
APPLY	40	50	5	5	50
ANALYZE		20	5	5	20

EVALUATE					
CREATE					

COURSE LEVEL ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): (Apply)

Write algorithm and draw flowchart
1. To count the even numbers between 1 and 200 and print the sum
2. To calculate the simple interest and compound interest
3. To calculate sum of the digits of a number and check if "sum" is an Armstrong number

Course Outcome 2 (CO2): (Apply)

1. Write a program to print the grade of a student based on his marks using switch case.
2. Write a program to print the following pattern

   1
   22
   333
   4444
   55555

3. Write a program to input the elements of a two dimensional array. Then from this array make two arrays: one that stores all the odd elements of the array and other that stores all the even elements of the array

Course Outcome 3 (CO3): (Apply)

1. Write a program using function to calculate 'x' to the power of 'y' where 'y' can be positive or negative.
2. Write a program to read a paragraph. Then count the number of words, number of lines, number of vowels and number of sentences in it
3. Find the output of the following:

   ```
   main(){
   char *str="ABCDEFGH";
   (*str++);        // what will happen if str++; is given here??
   printf("%s",str);    }
   ```

Course Outcome 4 (CO4):   (Apply)

1. What will be the output of the C program?

   ```
   #include<stdio.h>
   int main() {
   enum numbers
   {
   n1 = 1.5, n2 = 0, n3, n4, n5, n6
   };
   printf("%d %d\n", n1, n2);
   }
   ```

2. How many bytes in memory taken by the following C structure?

   ```
   #include <stdio.h>
   struct test {
   int k;
   char c;
   };
   ```

Course Outcome 5 (CO5): (Apply)

1. Write a program to create a file and store 20 names in it. Write a program to read the names in the file in the reverse order without reopening the file
2. Write a program that reads the file name and text of 20 words as command line arguments. Write the text into a file whose name is given as the file name

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED
UNIT I- INTRODUCTION TO PROBLEM SOLVING AND BASICS OF C PROGRAMMING		
1	Introduction to Computer Software, Generations of programming languages	1
2	Problem solving and logical thinking	1
3	Algorithm	2
4	Flowcharts, practical examples	2
5	Characteristics of C, uses of C, Structure of a 'C' program	1
6	Files used in C programs, Compiling and executing C programs	1
7	C Tokens, Character Sets in C	1
8	Keywords, Identifiers, Using comments in C	1
UNIT II- DECISION CONTROL STATEMENTS AND ARRAYS		
9	Data Types, Variables, Constants, Managing Input and Output operations in C	1
10	Operators and Expressions	1
11	Type Conversion- Type casting	1
12	Decision Making: Branching and Iterative statements	1
13	Iterative statements, Nested Loops	1
14	Iterative statements , break and continue statements	1
15	Arrays: Declaration, Initialization- Operations	1
16	One dimensional Arrays	1
17	Two Dimensional Arrays	1
18	Multidimensional Arrays	1
UNIT-III FUNCTIONS, STRINGS AND POINTERS		

19	Functions: Declaration and prototyping, Definition, Types	1
20	Call and Return statement- Parameter passing methods	1
21	Recursion and types.	1
22	Strings: String operations, Arrays of Strings	2
23	Pointers: Declaration, Definition, Pointer Arithmetic, Null pointers	1
24	Pointers and Arrays	1
25	Pointers and Functions	1
26	Pointers and Strings, Pointers to Pointers	1
27	Dynamic Memory Allocation	1
UNIT-IVSTRUCTURE, UNION AND ENUMERATED DATA TYPES		
28	Structure: Declaration and Initialization	1
29	Nested Structures, Array of Structures	1
30	Structures and functions	1
31	Pointers to structures	1
32	Self-referential structures	1
33	Unions: Declaration and Initialization, Arrays of union variables	1
34	Unions inside structures	1
35	Enumerated data types	1
UNIT-V FILE PROCESSING AND PRE PROCESSOR DIRECTIVES		
36	Introduction to Files, Using Files in C	1
37	Read data from files, Write data to files	1
38	Error Handling during file operations	1
39	Command line arguments, Random file functions	1
40	Pre processor Directives: Introduction, Types	1
41	Unconditional directives	1
42	Conditional Directives, examples	1

21HS1101	ENGLISH FOR PROFESSIONAL COMMUNICATION	L	T	P	C
		2	0	2	3

Preamble

This course is offered to equip students with the necessary skills to listen, read, write, and speak so as to comprehend and successfully convey any idea, technical or otherwise, as well as give them the necessary polish to become persuasive communicators.

Prerequisites for the course

The prerequisite knowledge required to study this Course is the basic knowledge in English Language.

Objectives

1. To develop listening skills, and enhance the ability of comprehending.
2. To communicate confidently in varied real life situations.
3. To widen the basic reading skills of the first year Engineering and Technology students.
4. To master vocabulary, sentence structure and to write articles.
5. To create emotional awareness.

Module I	SHARING BASIC INFORMATION	12

Listening - Listening to basic technical concepts, short formal and informal conversations; Speaking- Formal Self-Introduction – Etiquette – Phrases to be used highlighting the characteristics, strengths and weaknesses - Conversation Practice; Reading - short comprehension passages on fundamental concepts, principles, and ideas that helps to understand the need of Technology in a rapidly changing global environment; Writing - restructuring sentences from the jumbled words – creating coherence; Language development - Framing Yes/No questions, Question tag, Vocabulary development - formation of words– verb – Noun – Adjectives, Standard Abbreviations related to Engineering.

Suggested Activities	Evaluation Method
i) Listening to Conversations/ technical concepts from suggested app/prescribed modules - Submission of 5 Recorded Conversations. ii) Introducing oneself to the audience in a professional way - Video Recording to be submitted. iii) Reading 3 Passages on Technology and answering questions through Google forms. iv) Rearranging Jumbled words - Exercises v) Teaching of Grammar Contents	i) Listening & Speaking: Submitted Conversation will be assessed for a) Language style as that of the sample audio. b) Pronunciation c) Intonation ii) Introduction: Submitted Video Recording will be assessed for a) Communication Etiquette b) Language Style c) Sentence Construction Activities iii to v will be assessed through Google form tests/ written tests.

Module II	SHARING TECHNICAL INFORMATION	12

Listening - Listening to technical lectures by native speakers; Speaking - introducing a device/gadget to the audience – giving importance to its specifications, descriptions, merits and demerits; Reading - extensive reading – short narratives and news items from newspapers related to technology; Writing - sentence structure – short passages / reviews on any gadget – describing an electronic/ mechanical gadget, importance of punctuation, organizing paragraphs; Language development - framing 'Wh' Questions, writing a complete sentence using the fragments given; Vocabulary development- prefix and suffix.

Suggested Activities	Evaluation Method
i) Listening to Technical Lectures -	i) Listening skills will be tested through

Suggested Youtube channels
    a) Learn Engineering
    b) Jared Owen
    c) Interesting Engineering
    d) Practical Engineering
ii) Speaking / Submitting video recording / classroom presentation about an electronic/electrical/ a mechanical gadget giving importance to its specifications, descriptions, merits and demerits.
iii) Reading articles from Newspaper/ Google News / Times Now / and other Tech News Sites
iv) Writing reviews of a product
v) Teaching of Grammar Contents
	a) MCQs - Google Forms - 3 Sets
	b) Quiz - Polling - 2 set
	ii)Speaking: Submitted Video Recording/Presentation during class hours will be assessed for
	a) Language Style & Fluency
	b) Creation of Google Slides / Canva Slides
	c) Content delivery
	
	Activities iii to v will be assessed through Google form tests/ written tests.

Module III	UNDERSTANDING TECHNOLOGY	12

Listening - listening to technical talks on emerging trends and filling in the blanks – cloze test; Speaking - asking for opinions about technical gadgets – presentation of reviews on electronic/electrical/mechanical/software products; Reading - Reading Comprehension – technical passages – Articles from journals; Writing - rearranging jumbled sentences, writing short essays; Language development - Direct Speech and Indirect Speech – Framing Indirect – Questions - Prepositions – Articles; Vocabulary development – Select Single Word Substitutes used in Engineering.

Suggested Activities
i) Listening to Technical talks on emerging trends - Suggested YouTube channels
    a) Bernard Marr
    b) Concerning Reality
    c) Ideas and Inspiration
ii) Speaking / Submitting video recording / classroom presentation on giving reviews about a product.
iii) Reading articles -Extracts from reputed journals.
iv) Writing essays and rearranging Jumbled Sentences.
v) Teaching of Grammar Contents
	Evaluation Method
	i) Listening skills will be tested through
	a) Cloze Test - 2 Sets
	ii)Speaking: Submitted Video Recording/Classroom presentation will be assessed for
	a) Inquisitiveness
	b) Analytical skills
	c) Presentation Skills
	Activities iii to v will be assessed through Google form tests/ written tests.

Module IV	STATING PROBLEMS AND EXPRESSING SOLUTIONS	12

Listening- listening to talks relating to technology and noting down the merits and demerits; Speaking - stating a problem and expressing solutions giving more focus on pronunciation of words and sentence structure; Reading - comprehending Articles from Magazines – Identify the problem statement and note down solution statements; Writing - Identifying problems – Writing problem statement, Analyzing the situation – Gathering information related to the problem stated – Identifying solution criteria – Choosing the best solution – Implementing a solution – writing solution content - Measuring solution success – Report preparation – White paper writing – Release/launch notes; Language development- Tenses; Vocabulary development- Synonyms, Antonyms, Phrasal Verbs.

Suggested Activities	Evaluation Method

i) Listening to talks related to Technology - Suggested YouTube channels
    a) Auto Car India
    b) Lesics
    c) Student Energy
ii) Speaking / Submitting video recording / Classroom presentation on Technical issues faced in a gadget and expressing suitable solutions.
iii) Reading articles -Extracts from reputed journals and identify problem statements and solution statements.
iv) Writing - Identifying problems – Writing problem statement, Analyzing the situation – Gathering information related to the problem stated – Identifying solution criteria – Choosing the best solution – Implementing a solution – writing solution content - Measuring solution success – Report preparation – White paper writing – Release/launch notes
v) Teaching of Grammar Contents
	i) Listening skills will be tested through
	a) Note making - 2 Sets
	ii)Speaking: Submitted Video Recording / Classroom Presentation will be assessed for
	a) Expression of Innovative Ideas and Solution
	b) Sentence Structure
	
	Activities iii to v will be assessed through Google form tests/ written tests/ written exercises.

Module V	EMOTIONAL AWARENESS AND MANAGEMENT	12

Listening - Listening Types - Appreciative listening – Critical Listening – Relationship Listening; Speaking - presentation on the importance of Emotional Intelligence; Reading- Reading Articles on High Level Cognition - Cognitive Control – Decision Making – Social Behaviour – Emotion – Language and Consciousness; Writing - Articulate emotions using the right language - Balance optimism and pessimism to effectively impact others; Language development - modal verbs; Vocabulary Development - Fixed and Semi-Fixed Expressions.

Suggested Activities
i) Watching videos on types of Listening
ii) Presentation on Emotional Intelligence
iii) Reading Articles on High Level Cognition
iv) Writing - Articulate emotions using the right language - Balance optimism and pessimism to effectively impact others
v) Teaching of Grammar Contents
	Evaluation Method
	i) Listening skills will be tested through
	a) Google form test- 2 Sets
	ii)Speaking: Submitted Video Recording / Classroom Presentation will be assessed for
	    a) Emotional awareness
	    b) Communication Skills
	Activities iii to v will be assessed through Google form tests/ written tests/ written exercises.

S.No	List of Exercises	CO
1.	Conversation Recording using the suggested app	CO 1
2.	Self Introduction Video	CO 1
3.	Listening Test - Google Form	CO 2
4.	Presentation on the working principle of a gadget	CO 2
5.	Listening - Cloze Test	CO 3
6.	Reviewing a Product - Video Submission	CO 3
7.	Listening and Note Making	CO 4
8.	Talk on technical issues in a gadget and express suitable solutions.	CO 4

9.	Types of Listening - Google Form	CO 5
10.	Presentation on Emotional Intelligence	CO 5
Total Periods		30 Theory +30 Lab

Laboratory Requirements for a batch of 60 Students
Software: Globarena
1. Teacher console and 30 systems for students.
2. English Language Lab Software
3. Career Lab Software

Suggestive Assessment Methods:
1) Listening and answering questions - MCQ - Cloze Test - Note Making
2) Speaking - App/Software based testing
3) Reading - analyze the passage given - understand the concept and answer Questions - On-line Based
4) Written Tests

Continuous Assessment Test (30 Marks)	**Lab Components Assessments (20 Marks)**	**End Semester Exams (50 Marks)**
Written Examination	Completion of Suggested Exercises	Written Examination

Outcomes

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

CO 1	Enumerate basic information using communication etiquette on par with international communication standards.
CO 2	Interpret fundamental technical concepts in English language giving importance to syntax.
CO 3	Evaluate advanced varied technical concepts in the current scenario and emerging trends to invent new concepts.
CO 4	Write solutions for problems identified using the exact vocabulary and structure without grammatical errors as expected by the corporate world.
CO 5	Manage and respond to self, others' emotions using skills of Self Awareness, Self Management, Self Motivation, Empathy & Social Relations to be an Emotionally Intelligent Human Being.

Text Books
1. Butterfield, Jeff. Soft Skills for Every one. Cengage Learning: New Delhi,2017.
2. Sudharshana.N.P and Saveetha. C. English for Technical Communication. Cambridge University Press: New Delhi, 2016.

Reference Books

1. Kumar, Suresh. E. Engineering English. Orient Blackswan: Hyderabad,2015
2. Means, L. Thomas and Elaine Langlois, English & Communication For Colleges.

Web Resources
1. Self Introduction: https://youtu.be/Osa53-RYBk4
2. Working Principle of a Gadget: https://www.youtube.com/channel/UC6qf8AGvAGixZXWdxapvCqw
3. Product Review: https://youtu.be/ByhA05x7CWI
4. Times of India: https://timesofindia.indiatimes.com/home/headlines
5. Listening to Technical talks:

Auto Car India https://m.youtube.com/user/autocarindia1
Lesics : https://www.youtube.com/channel/UCqZQJ4600a9wIfMPbYc60OQ
Student Energy https://www.youtube.com/user/studentenergy?app=desktop
6. Types of Listening https://www.youtube.com/watch?v=22gzvSindTU&t=1s

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1				2					1	1	2	2		
2									2	3				
3							2				2	2		
4										2	2	2		
5									2	3				

Assessment Pattern

BLOOM'S CATEGORY	ASSESSMENT TESTS				END SEMESTER EXAMINATION
	CAT – 1	CAT -2	FAT - 1	FAT - 2	
REMEMBER	10	10	5	5	10
UNDERSTAND	30	30	10	10	30
APPLY	60	60	10	10	60
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0

SUGGESTED COURSE LEVEL ASSESSMENT QUESTIONS:

COURSE OUTCOME 1 (CO 1) : Enumerate basic information using communication etiquette on par with international communication standards.
1) Listen to the talk on basic technical topics and answer the questions provided.
2) Introduce yourself in a professional way highlighting Characteristics, Strengths & Weaknesses.
3) Converse with your friend on any fundamental concepts in Technology.
4) Read the given technical passage and answer the questions provided.
5) Frame Yes/No Questions for the statements given.
6) Frame Question tags for the statements given.
7) Rearrange the jumbled words into a meaningful sentence.
8) Complete the sentence with the Noun form/ Verb Form/ Adjective form (as Directed) of the word given.
9) Give the expansion of the Abbreviations given.

COURSE OUTCOME 2 (CO 2) : Interpret fundamental technical concepts in English language giving importance to syntax.
1) Listen to the technical lecture and answer the questions provided.
2) Introduce a device or a gadget to the class giving importance to its specifications, description, merits and demerits.
3) Read the given passage / short narrative / article from a journal or newspaper to the class.

4) Write your review on any one of the gadgets you are using.
5) Frame "Wh" Questions for the statements given.
6) Punctuate the following statement given.
7) Complete the sentence using the fragments given.
8) Write a short passage on the given topic.
9) Fill in the blanks with the suitable prefix or suffix as directed.

COURSE OUTCOME 3 (CO 3) :Evaluate advanced varied technical concepts in the current scenario and emerging trends to invent new concepts.
1) Listen to the technical talk on the emerging trends and complete the statements given. (Cloze Test)
2) Ask questions to get an opinion about technical gadgets / software / devices
3) Read the given article from a journal and provide your ideas for further developments.
4) Rearrange the following sentences in the proper chronological order.
5) Write a short essay on any one of the given technical topics highlighting the future scope of the product.
6) Rewrite the following into Indirect Speech.
7) Frame indirect questions for the questions given.
8) Fill in the blanks with the suitable articles.
9) Give the one word substitutes for the given statement.

COURSE OUTCOME 4 (CO 4) : Write solutions for problems identified using the exact vocabulary and structure without grammatical errors as expected by the corporate world.
1) Listen to the technical talks and write down the merits and demerits of the product discussed.
2) Watch the video, evaluate the concept and express your solutions to the problem.
3) Read the given article and note down the problems stated.
4) Write down solutions for the problems faced while using a product.
5) Draft a white paper writing for the given situation..
6) Write launch notes for a product.
7) Convert the given statement to another form of the tenses as directed.
8) Pick out the suitable synonym for the underlined word in order to minimize plagiarism.
9) Fill in the blank with the suitable phrasal verb.

COURSE OUTCOME 5 (CO 5) : Manage and respond to self, others' emotions using skills of Self Awareness, Self Management, Self Motivation, Empathy & Social Relations to be an Emotionally Intelligent Human Being.
1) Watch the video on Types of listening and answer the questions.
2) Make a presentation on the importance of Emotional Intelligence.
3) Read the given article on High level cognition and answer the questions.
4) Read the article on social behaviour and redraft it in your own style.
5) Comprehend the passage and give your inputs for decision making.
6) Watch the video and articulate your emotions using appropriate words.
7) Write a note on optimism and pessimism.
8) Fill in the blank with the suitable modal verb.
9) Pick out the suitable fixed/ semi-fixed expression to complete the given statement.
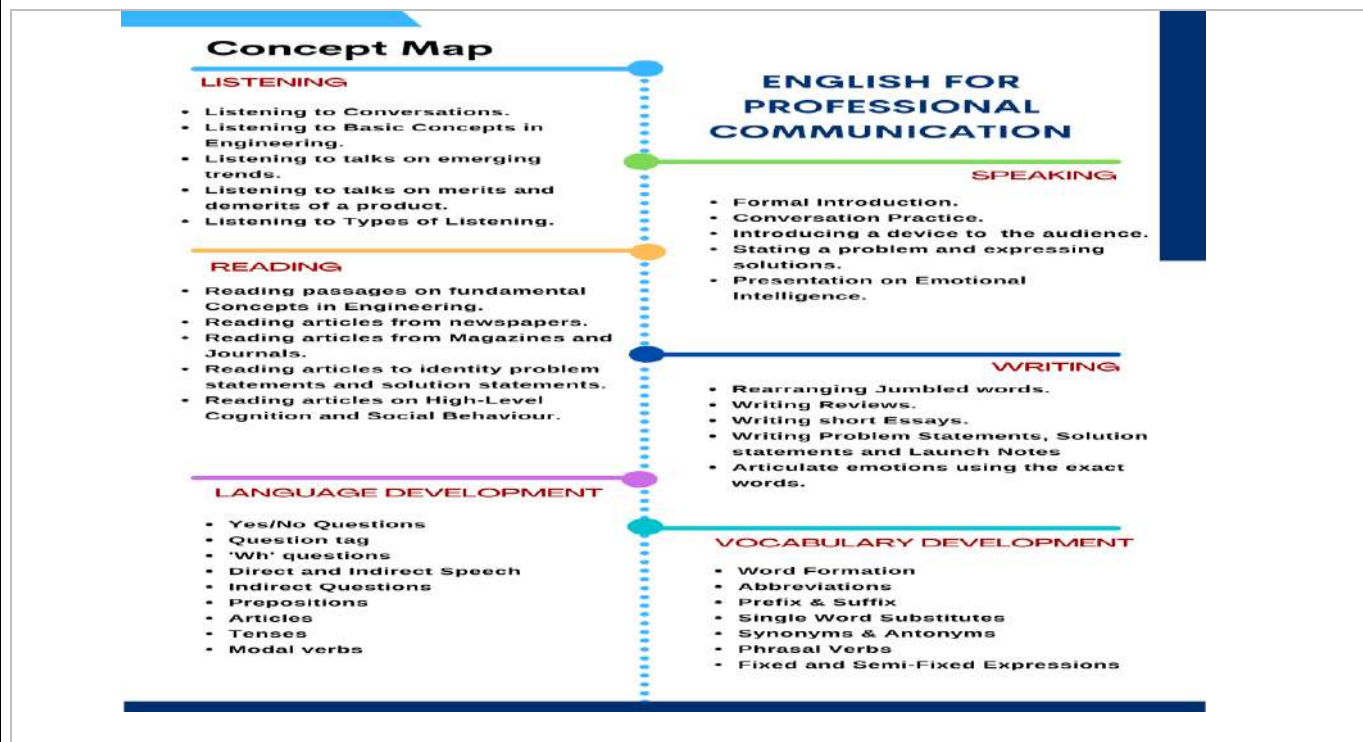
COURSE CONTENT AND LECTURE SCHEDULE

S.No	Topic	No. of Hours Required
MODULE I (12 Hrs)		
1.	Listening to basic Technical Concepts	1
2.	Formal & Informal Conversation	1
3.	Formal Self Introduction	2
4.	Conversation Practice	2
5.	Reading Short Technical Passages	1
6.	Jumbled words / Sentences	1
7.	Yes/No questions and Question tag	2
8.	Formation of Words	1
9.	Standard Abbreviations related to Engineering.	1
MODULE II (12 Hrs)		
10.	Listening to technical lectures by native speakers	2
11.	Introducing a device/gadget to the audience	2
12.	Extensive Reading	1
13.	Reading short narratives and news items from newspapers related to technology	1
14.	Writing reviews on any gadget – describing an electronic/ mechanical gadget	2
15.	Importance of punctuation, organizing paragraphs	1
16.	'Wh' Questions	1
17.	writing a complete sentence using the fragments given	1
18.	Prefix and Suffix	1

	MODULE III (12 Hrs)	
19.	Listening to technical talks on emerging trends and filling in the blanks – cloze test	2
20.	asking for opinions about technical gadgets – presentation of reviews on electronic/electrical/mechanical/software products	2
21.	Reading Comprehension – technical passages – Articles from journals	1
22.	Rearranging jumbled sentences, writing short essays	1
23.	Direct Speech and Indirect Speech	2
24.	Framing Indirect Questions	1
25.	Prepositions	1
26.	Articles	1
27.	One word Substitute	1
	MODULE IV (12 Hrs)	
28.	Listening to talks relating to technology and noting down the merits and demerits	2
29.	Stating a problem and expressing solutions giving more focus on pronunciation of words and sentence structure	2
30.	Reading and comprehending Articles from Magazine	1
31.	Identify the problem statement and note down solution statements	1
32.	Writing Solution Statements	1
33.	Writing White Paper and Release / Launch Notes	2
34.	Tenses	1
35.	Synonyms & Antonyms	1
36.	Phrasal Verbs	1
	MODULE V (12 Hrs)	
37.	Types of Listening	1
38.	Presentation on Emotional Intelligence	2
39.	Reading Articles on High Level Cognition	1
40.	Decision making and Social behaviour	1
41.	Emotion - language and Consciousness	1
42.	Articulating Emotions - Using the right Language	2
43.	Balance between Optimism and Pessimism	2
44.	Modal Verbs	1
45.	Fixed and Semi-fixed Expressions	1

21ME1513	COMPUTER AIDED ENGINEERING GRAPHICS	L	T	P	C
		2	1	2	4

Prerequisites for the course

NIL

Preamble

Engineering drawing is an important tool for all Engineers and for many others professionals. It is the language of Engineers. Engineering Drawing communicates all needed information from the engineer who designed a part to the workers who will manufacture it.

Objectives

1. To understand the importance of the drawing in engineering applications
2. To improve their visualization skills so that they can apply this skill in developing new products
3. To expose them to existing standards related to technical drawings
4. To develop graphic skills for communication of concepts, ideas and design of engineering products
5. Train to practice engineering graphics through drafting software.

CONCEPTS AND CONVENTION
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout of drawing sheets – Lettering and Dimensioning

UNIT I	PROJECTION OF POINTS, LINES AND PLANES	9
General Principles of orthographic projection – First Angle Projection, projection of points in four quadrants – Projection of straight lines located in the first quadrant – inclined to both planes – Projection of planes (Change of position method only)		
UNIT II	**PROJECTION OF SOLIDS**	**10**
Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.		
UNIT III	**SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES**	**10**
Sections of regular solids as per BIS conventions - Constructing sectional views of simple objects and components - Development of lateral surfaces of regular solids-Projection of truncated solids- Combinations of solids		
UNIT IV	**ISOMETRIC PROJECTIONS**	**8**
Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.		
UNIT V	**PERSPECTIVE PROJECTIONS**	**8**
Perspective projection of prisms, pyramids and cylinders by visual ray method.		

S.No	List of Experiments	CO
1.	Introduction to drafting commands in AutoCAD. Creation of simple geometry and editing practice.	C112.1, C112.6
2.	Projection of simple Geometric objects and engineering components using AutoCAD	C112.2, C112.6
3.	Construction of simple objects and components sectional views using AutoCAD	C112.3, C112.6
4	Construction of development of surfaces of simple solids	C112.3,C112.6
5.	Isometric projection of simple components-flange, cylinder, chimney, lamp shades, valve, Brackets using AutoCAD	C112.4, C112.6
6.	Creating a Perspective Projection of solids using AutoCAD	C112.5, C112.6
	Total Periods	**25 Lecture+20 Tutorial+ 15 Lab Hours**

Laboratory Requirements
SYSTEM REQUIREMENTS (For a batch of 30 Students)

Hardware:
1. Intel i3 core due processor with 4GB ram with 500GB hard disk – 30 Nos.
2. Laser Printer – 1 No.

Software:

Drafting package – AutoCAD – Adequate license (Open source)

Suggestive Assessment Methods

CAT 1 (20Marks)	Model Lab (30 Marks)	End Semester Exams (50 Marks)
20	30	50

Outcomes

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

C109.1: Apply the principles of first angle projection in construction of points, lines and planes

C109.2: Apply the principles of change of position method in projection of simple solids.

C109.3:Develop projections of sectioned solids and their developmental surface.

C109.4:Develop isometric views from orthographic projections

C109.5: Construct the perspective projections of simple solids

C109.6:Develop orthographic ,isometric and perspective projection and development of surfaces using drafting software.

Text Books

1. Venugopal K. and Prabhu Raja V., "Engineering drawing + AutoCAD", New Age International (P) Limited (2022)
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2015)
3. Patil, Rajashekar, "Computer Aided Engineering Graphics", New Age International Ltd,2018

Reference Books

1. Kumar M.S., "Engineering Graphics", D.D. Publications, (2015)
2. Parthasarathy N.S. and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, (2015)
3. Shah M.B. and Rana B.C., "Engineering Drawing", Pearson Education (2009)
4. N.D.Bhatt, "Engineering Graphics", Charotor Publishing House, 53RD Edition 2019

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

Web Recourses

1. http://nptel.ac.in/courses/112103019
2. https://archive.nptel.ac.in/courses/112/105/112105294/

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	MODEL	END SEM EXAM

REMEMBER				
UNDERSTAND				
APPLY	10	10	30	50
ANALYZE				
EVALUATE				
CREATE				

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: Apply the principles of first angle projection in construction of points and lines. (Apply)

1. Draw the projections of the following points on a common reference line. (Apply)
   A,35 mm above HP and 25 mm in front of VP
   B,40 mm below HP and 15mm behind VP
   C,50 mm above HP and 25 mm behind VP
   D,45 mm below HP and 25 mm behind VP
   E, 30 mm behind VP and on HP

2. A line CD measuring 80 mm is inclined at an angle of 30° to HP and 45° to VP. The point C is 20 mm above HP and 30 mm in front of VP. Draw the projections of the straight line.(Apply)

COURSE OUTCOME 2: Apply the principles of change of position method in projections of solid problems and draw graphically

1. A pentagonal pyramid of base side 25mm and height 40mm, is resting on the ground on one of its triangular faces. The base edge of that face is inclined 30o to VP. Draw the projections of the solid. (A)

2. A hexagonal prism has side 25mm and height 50mm has a corner of its base on the ground and the long edge containing that corner inclined at 30o to HP and 45o to VP. Draw the projections of the solid. (A)

COURSE OUTCOME 3: Develop projections of sectioned solids and their developmental surface.

1. A cylinder of base diameter 50mm and height 60mm rest on its base on HP. It is cut by a plane perpendicular to VP and inclined at 45^0 to HP. The cutting plane meets the axis at a distance 15mm from its top base. Draw the sectional plan and true shape of the section. (A)

2. A regular hexagonal pyramid side of base 30 mm and height 60 mm is vertically on its base on HP, such that two of its sides of the base are perpendicular to VP. It is cut by a plane inclined at 30° to HP and perpendicular to VP. The cutting plane bisects the axis of the pyramid. Obtain the development of the lateral surface of the truncated pyramid. (A)

COURSE OUTCOME 4: Develop isometric views from orthographic projections

1. A cone of diameter 50 mm and axis 70 mm rests on its base on HP. A section plane perpendicular to VP and inclined at 30° to HP cuts the solid and passes through a point on axis which is 40 mm above HP. Draw the isometric view of a truncated cone. (A)

2. A pentagonal pyramid of base edge 25 mm and height 65 mm rests vertically on its base on the HP such that one of its base edge parallel to VP. It is cut by a plane, parallel to HP and perpendicular to VP and passes through a point 25 mm from the apex. Draw the isometric view of the frustum of pyramid. (A)
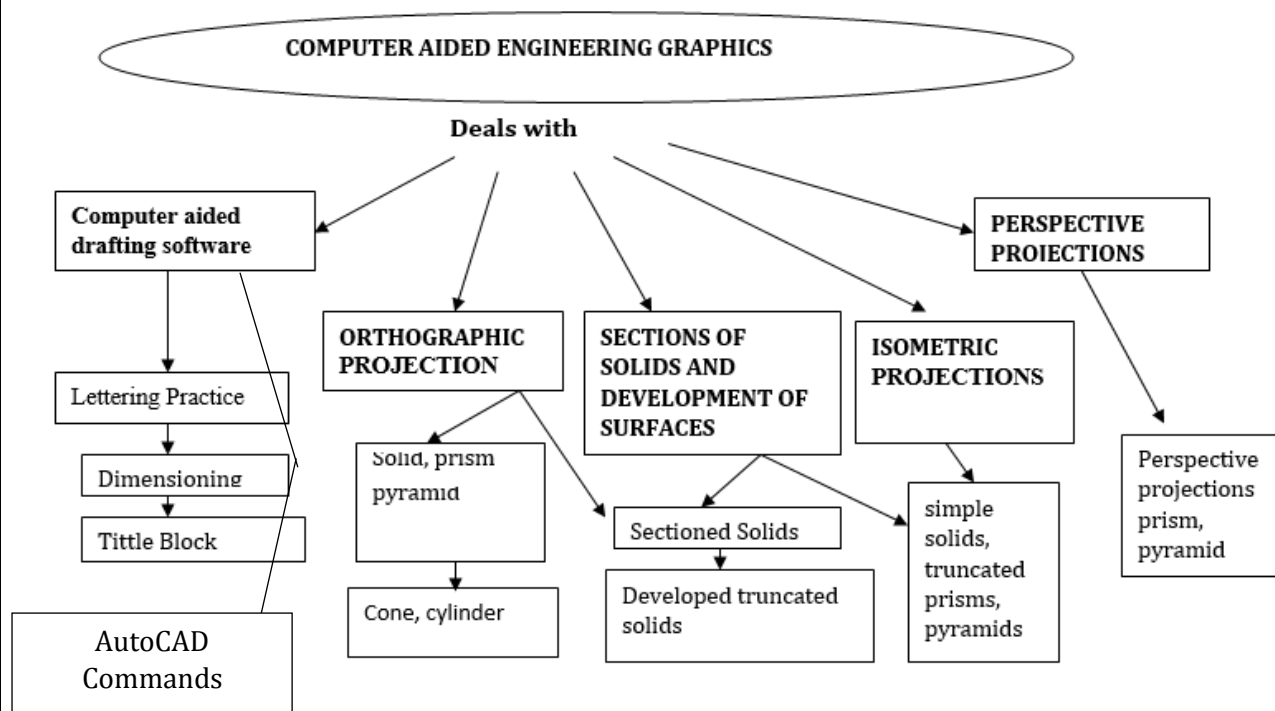
COURSE OUTCOME 5: Construct the perspective projections of simple solids

1. Draw the perspective view of a square prism of base side 40mm and height 50mm. one vertical lateral face is parallel to PP and 30mm away from it. The station point is 80mm from PP, 80mm above the base and 60mm to the right of the axis of the prism. (APPLY)

2.A hexagonal pyramid of base side 25mm and axis length 50mm is resting on GP on its base with a side of base is parallel to and 20mm behind PP. The station point is 60mm above GP and 80mm in front of PP and lies in a central plane which is 50mm to the left of the axis of the pyramid. Draw the perspective view of a pyramid. (APPLY)

COURSE OUTCOME 6: Students will be able to Develop Orthographic ,isometric and perspective projection and Development of surfaces using drafting software

1. A hexagonal pyramid of base side 30 mm axis length 60 mm is resting on HP on one of its base corners with its axis inclined at 35° to HP and parallel to VP. Draw its projections. (APPLY)

2. A cylinder of base diameter 50mm and axis length 50mm is placed horizontally on GP on its base. The axis of the cylinder is 35mm behind PP. The station point is 70mm in front of PP and 70mm above the GP and is 50mm to the left of the axis. Draw the perspective projection of the cylinder. (APPLY)

CONCEPT MAP

21PY1311	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Preamble

The aim of this course is to make the students gain practical knowledge to co-relate with the theoretical studies and develop their practical applications in engineering materials by using the principles in the right way to implement in modern technology.

Prerequisites

Basic practical concepts of Physics and Chemistry in higher secondary level.

Objectives

● To understand the measurement techniques and usage of instruments in physics.

● To demonstrate competency and understanding of the basic concepts found in experimental

Physics.
● To learn about the various electronic communication mechanisms and their usage in a practical manner.
● To make the students acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
● To develop an understanding about the range and uses of analytical methods in chemistry.

PHYSICS

S. No	List of Experiments (Any Five)	CO
1	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.	3
2	Determination of band gap of a Semiconductor (Forbidden energy band gap kit).	3
3	Determination of planck's constant and work function using the principle of photoelectric effect	1
4	Determination of Wavelength, and particle size using Laser.	2
5	Determination of Numerical aperture and acceptance angle in an optical fiber.	2
6	Determination of Young's modulus of the material-Non Uniform bending method.	1
7	Determination of rigidity modulus – Torsion pendulum.	1
8	Determination of thermal conductivity of a bad conductor – Lee's Disc method.	2
9	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.	1
10	Determination of wavelength of spectral lines using grating – Spectrometer.	2

CHEMISTRY (Any Five)

1	Determination of total, temporary & permanent hardness of water by EDTA method.	4
2	Corrosion experiments – weight loss method.	5
3	Estimation of iron content of the given solution using potentiometer.	5
4	Conductometric titration of strong acid vs strong base.	5
5	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	5
6	Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.	4
7	Determination of strength of given hydrochloric acid using pH meter.	5
8	Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol- Gel method.	5
9	Estimation of sodium and potassium present in water using a flame photometer.	5
10	Determination of strength of acids in an acid mixture using conductivity meter.	5

List of Projects (PHYSICS)

S. No.	List of Projects	Related Experiment	CO
1.	To study Infrared radiation emitted by different sources using phototransistors.	3	1
2	To study the variations, in current flowing in a circuit	2	3

	containing a LDR, because of a variation: (a) In the power of the incandescent lamp, used to 'illuminate' the LDR. (Keeping all the lamps at a fixed distance). (b) In the distance of an incandescent lamp, (of fixed power), used to 'illuminate' the LDR.		
3	Design a circuit for cool automatic timer controlled Light which controls vehicle traffic passing through the intersection of two or more roadways by giving a visual indication to drivers when to proceed, when to slow , and when to stop using LED and 4017 counter IC along with the 555 timer.	2	3
4	Design and implement a circuit which anyone can make at home to save their home from thefts using the light has high intensity, monochromatic, directional and coherent in nature.	4	2
5	Construct a household circuit consisting of three bulbs using a dual switching method.	1	3
6	Using ultrasonic sensor, design a ultrasonic distance finder using 8051	9	1
7	Design a water level indicator by connecting a Buzzer, resistor and transistor in series and connect this in parallel to LED.	2	3
List of Projects (CHEMISTRY)			
1	Water Analysis : Analysis of perennial Thamirabarani River water samples collected from various locations (before and after blending of industrial waste water). i) Determination of various physical and chemical parameters (Hardness, pH,TDS, Alkalinity) of different water samples. ii) From the result, give a detailed report about the water sample whether it is fit/unfit for domestic and industrial purposes.	1, 6	4
2.	Water Quality Monitoring : Analysis of ground water samples collected from various districts (Tirunelveli, Madurai, Tuticorin, Kanyakumari, Tenkasi etc.,). i) Determination of various physical and chemical parameters (Hardness, pH, TDS, Alkalinity) of different water samples. ii) From the result, give a detailed report about the water sample whether it is fit/unfit for domestic and industrial purposes.	1,6	4
3.	Household Plumbing Deterioration Monitoring : Study of Conductivity of domestic water (Home) by Arduino method to track the deterioration of household plumbing. i) From the observations give a detailed report about the existence of various ions in water. ii) Give an explanatory report on tracking the deterioration in household plumbing.	4	5
4	Air quality monitoring : Study of air pollution in Nellai smart city in the early morning, noon and evening due to CO/CO_2 emissions by Arduino method. i) From the observations give a detailed report about the impact of air pollution on human health. ii) Deduce an explanatory report on environmental impact	4,10	5

	due to CO/CO2 emissions.		
5.	Food adulteration : Investigation of adulterants in various food stuffs (milk, chilli powder, turmeric powder, wheat flour, honey and ghee) by Chemical methods. i) Give a report on the presence of adulterants in the given food samples. ii) From the observations give a brief report about the impact of food adulteration on human health.	1	4
6.	Design of molecules (composites) by computational techniques.	4,10	5

Lab Assessment

Lab Components Assessments (50 Marks)	End Semester Exams (50 Marks)

Outcomes

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

CO1	Understand measurement technology, usage of new instruments and real time applications in engineering studies.(Understand)
CO2	Operate different instruments and be capable of analysing the experimental results. (Analyse)
CO3	Applying basic knowledge to design various circuits (Apply)
CO4	Have knowledge and will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters. (Apply)
CO5	Gain knowledge and will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems. (Apply)

Reference Books

- Physics Laboratory Manual, Department of Physics, Francis Xavier Engineering College, Tirunelveli.
- A Textbook of Engineering Physics Practical, UNIVERSITY SCIENCE PRESS (An Imprint of Laxmi Publications Pvt. Ltd.)2nd edition.
- J.Mendham, R.C. Denney, J.D.Barnes, M.Thomas and B.Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (5th edition 2009).

Web Resources

Virtual Lab - https://bop-iitk.vlabs.ac.in/basics-of-physics/List%20of%20experiments.html
Young's Modulus- https://vlab.amrita.edu/?sub=1&brch=280&sim=550&cnt=1
Virtual Lab - https://www.vlab.co.in/ba-nptel-labs-physical-sciences
Numerical Aperture - https://vlab.amrita.edu/index.php?sub=1&brch=189&sim=343&cnt=1
Water Quality standards - https://www.youtube.com/watch?v=OlGllOZlIyI

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	2	1						1		1	1		
2	3	2	1						1		1	1		
3	3	2	1						1		1	1		
4	3	2	1						1		1	1		
5	3	2	1						1		1	1		

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: The students will be able to understand measurement technology, usage of new instruments and real time applications in engineering studies (Understand)

1. Find the Young's modulus of the material of a beam using Non-Uniform bending method. (Given : Thickness of the beam d = 6.35 mm)

COURSE OUTCOME 2: The students will be able to operate different instruments and be capable of analysing the experimental results (Analyse)

2. Using a given laser source and grating (i) determine the wavelength of the given laser light source and also using a given laser source and glass plate (ii) determine the average size of the particles of lycopodium powder by diffraction method.
3. Determine the thermal conductivity of a given bad conductor (Glass) using Lee's disc method. (Given: M= 800 X10^{-3} Kg, S = 370 JKg $^{-1}$K^{-1}).

COURSE OUTCOME 3: The students will be able to applying basic knowledge to design various circuits (Apply)

1. Design a circuit for finding unknown resistance and specific resistance of a given coil of wire.
2. Find the energy band gap of semiconductor diode.

COURSE OUTCOME 4: The students will be able to have knowledge and will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters. (Apply)

1. Estimate the amount of total hardness present in 250ml of the given water sample by EDTA method. You are provided with a standard hard water of strength 0.01N.What is the permissible limit of hardness in drinking water.
2. Calculate the amount of total alkalinity present in 500ml of the given water sample. You are provided with a standard NaOH solution of strength 0.01N.
   What is the permissible limit of alkalinity in drinking water?

COURSE OUTCOME 5: The students will be able to gain knowledge and will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.(Apply)

1. Determine the amount of NaOH present in 1000 ml of the given sample solution by pH metry. What is the pH of a blood sample?

2. Find the amount of HCl and CH3COOH present in 1000 ml of the given sample solution by Conductometry. Which Acid Is The Best Conductor Of Electricity?

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS REQUIRED
1	Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.	1
2	Determination of band gap of a Semiconductor (Forbidden energy band gap kit).	1
3	Determination of planck's constant and work function using the principle of photoelectric effect.	1
4	Determination of Wavelength, and particle size using Laser	1
5	Determination of Numerical aperture and acceptance angle	1

	in an optical fiber	
6	Determination of Young's modulus of the material-Non Uniform bending method.	**1**
7	Determination of rigidity modulus – Torsion pendulum.	**1**
8	Determination of thermal conductivity of a bad conductor – Lee's Disc method.	**1**
9	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.	**1**
10	Determination of wavelength of spectral lines using grating – Spectrometer.	**1**

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
1	3	2	1						1		1	1		
2	3	2	1						1		1	1		
3	3	2	1						1		1	1		
4	3	2	1						1		1	1		
5	3	2	1						1		1	1		

1-Low , 2- Medium, 3- High

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS REQUIRED
1	Determination of total, temporary & permanent hardness of water by EDTA method.	1
2	Corrosion experiments – weight loss method	1
3	Estimation of iron content of the given solution using potentiometer	1
4	Conductometric titration of strong acid vs strong base	1
5	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer	1
6	Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample	1
7	Determination of strength of given hydrochloric acid using pH meter.	1
8	Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol Gel	1

	method.	
9	Estimation of sodium and potassium present in water using a flame photometer.	1
10	Determination of strength of acids in an acid mixture using conductivity meter.	1

21CS1511	PROGRAMMING PRACTICE LAB USING C	L	T	P	C
		0	0	4	2

Preamble

The goal of the practice lab is to provide the students with foundation in computer programming to enhance the problem solving skills related to the field of engineering. It enables the algorithmic approach among the students to solve real world problems thus providing the base to learn other new programming languages

Prerequisites for the course

- **NIL**

Objectives

1. To develop C programs using conditional and looping statements
2. To be able to use arrays and strings in C
3. To build modular programs using functions in C
4. To explicitly manage memory using pointers in C
5. To develop applications in C using structures and files

S. No	List of Experiments	CO
1	Programs using simple statements	CO1
2	Programs using decision making statements	CO1
3	Programs using looping statements	CO1
4	Programs using one dimensional and two dimensional arrays	CO2
5	Programs using strings.	CO2
6	Programs using user defined functions and recursive functions	CO3
7	Programs using functions and pointers	CO3
8	Programs using structures and pointers	CO4
9	Programs using structures and unions	CO4
10	Programs using file concept	CO4

S.No.	List of Projects	Related Experiment	CO
1.	Vaccine Status Registration System	Ex. 1 to 10	CO5
2.	Toll Bill Management system	Ex. 1 to 10	CO5
3.	Voting Eligibility system	Ex. 1 to 10	CO5
4.	Cricket Scorecard Display system	Ex. 1 to 10	CO5
5.	Medical History Viewing System	Ex. 1 to 10	CO5
6.	Bus/ Flight Ticket Reservation System	Ex. 1 to 10	CO5
7.	Vehicle Parking Control System	Ex. 1 to 10	CO5
8.	Canteen Menu Management System	Ex. 1 to 10	CO5

9.	Grocery Checklist Management System	Ex. 1 to 10	CO5
10.	Diary Management System	Ex. 1 to 10	CO5
11.	Retail Shop Inventory Management System	Ex. 1 to 10	CO5
12.	Pharmacy Inventory System	Ex. 1 to 10	CO5
13.	Library Book Management System	Ex. 1 to 10	CO5
14.	Student Subject Selection System	Ex. 1 to 10	CO5
15.	Student Leave Application System	Ex. 1 to 10	CO5

Suggestive Assessment Methods

Lab Components Assessments (50 Marks)	End Semester Exams (50 Marks)
1. Exercises (Hacker rank score) 2. Project File (Progress Score) 3. Viva voce	1. Record note 2. Exercises 3. Viva voce

Course Outcomes

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

CO1	Implement program using control statements
CO2	Implement arrays and perform string operations
CO3	Develop reusable modules, store data in main memory effectively using pointers
CO4	Form heterogeneous data using structures, union and files
CO5	Build a project based on the required concepts learnt in C

Laboratory Requirements

- C compiler
- System with windows
- Internet

Reference Books

1. Reema Thareja, "Programming in C",Oxford University Press, Second edition, 2016

Web Resources

1. https://www.hackerrank.com/
2. https://www.codechef.com/selflearning?itm_medium=navmenu&itm_campaign=learncp
3. https://www.hackerearth.com/practice/basic-programming/input-output/basics-of-input-output/tutorial/

CO Vs PO Mapping and CO Vs PSO Mapping

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

3	3	3	3										2	
4	3	3	3										2	
5	2	2	2			1			2	2	2	1	3	

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	Model Exam	END SEM EXAM
REMEMBER		
UNDERSTAND		
APPLY	50	100
ANALYZE		
EVALUATE		
CREATE	50	

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1: (Blooms Category: Apply) (Problem Source: Code chef)
Problem Statement:
Pooja would like to withdraw X $US from an ATM. The cash machine will only accept the transaction if X is a multiple of 5, and Pooja's account balance has enough cash to perform the withdrawal transaction (including bank charges). For each successful withdrawal the bank charges 0.50 $US dollars. Calculate Pooja's account balance after an attempted transaction.
Input Constraints:
Positive integer $0 < X <= 2000$ - the amount of cash which Pooja wishes to withdraw.
Nonnegative number $0 <= Y <= 2000$ with two digits of precision – To represent Pooja's initial account balance.
Output Constraints:
Output the account balance after the attempted transaction, given as a number with two digits of precision. If there is not enough money in the account to complete the transaction, output the current bank balance.
Example:

TYPE	INPUT		OUTPUT
Successful Transaction	30	120.00	89.50
Incorrect Withdrawal Amount (not multiple of 5)	42	120.00	120.00
Insufficient funds	300	120.00	120.00

COURSE OUTCOME 2: (Blooms Category: Apply) (Problem Source: Code chef)
Problem Statement:
Write a program that takes in a letter class ID of a ship and display the equivalent string class description of the given ID. Use the table below.

Class ID	Ship Class
B or b	Battle Ship
C or c	Cruiser
D or d	Destroyer
F or f	Frigate

Input Constraints:

The first line contains an integer T, the total number of test cases. Then T lines follow, each line contains a character. $1 \leq T \leq 1000$

Output Constraints:

For each test case, display the Ship Class depending on ID, in a new line.

Example:

INPUT	OUTPUT
3	Battleship
B	Cruiser
C	Destroyer
D	

COURSE OUTCOME 3: (Blooms Category: Apply) (Problem Source: Hacker rank)

Problem Statement:

Functions are a bunch of statements grouped together. A function is provided with zero or more arguments, and it executes the statements on it. Based on the return type, it either returns nothing (void) or something. For example, a function to read four variables and return the sum of them can be written as

```
int sum_of_four(int a, int b, int c, int d) {
int sum = 0;
        sum += a;
        sum += b;
        sum += c;
        sum += d;
        return sum;                    }
```

+= : Add and assignment operator. It adds the right operand to the left operand and assigns the result to the left operand. So a += b is equivalent to a = a + b;

Task

Write a function int max_of_four(int a, int b, int c, int d) which reads four arguments and returns the greatest of them. Note that it is not built in max function in C. Code that will be reused is often put in a separate function that returns the greater of the two values.

Input Constraints:

Input will contain four integers(one on each line)

Output Constraints:

Print the greatest of the four integers.

Sample Input:3   4   6   5

Sample Output: 6

COURSE OUTCOME 4: (Blooms Category: Apply) (Problem Source: Hacker rank)

Problem Statement:

You are transporting some boxes through a tunnel, where each box is a parallelepiped, and is characterized by its length, width and height. The height of the tunnel feet and the width can be assumed to be infinite. A box can be carried through the tunnel only if its height is strictly less than the tunnel's height. Find the volume of each box that can be successfully transported to the other end of the tunnel. Note: Boxes cannot be rotated.

Input Constraints:

The first line contains a single integer, denoting the number of boxes. Lines follow with three integers on each separated by single spaces, and which are length, width and height in feet of the box.

Output Constraints:

For every box which has a height lesser than 41 feet, print its volume in a separate line.

SAMPLE INPUT			SAMPLE OUTPUT
4			
5	5	5	
1	2	40	125
10	5	41	80
7	2	42	

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED FOR EXERCISES	NO OF HOURS REQUIRED FOR PROJECT
1	Simple Statements	2	1
2	Decision Making Statements	2	1
3	Looping Statements	2	1
4	One Dimensional And Two Dimensional Arrays	2	1
5	Strings	2	1
6	Functions: User Defined Functions And Recursive Functions	2	1
7	Functions And Pointers	2	1
8	Structures And Pointers	2	1
9	Structures And Unions	2	1
10	Files Concept	2	1
11	Project Implementation & Integration	0	15
	Total	20	25
	Total Hours Required	45	

SEMESTER II

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21HS2101	English for Technical Communication	HSSM	2	2	0	0	2
2	21MA2201	Partial Differential Equation and Application of Fourier Series	BS	4	3	1	0	4
3	21EC2601	Semiconductor Devices and Circuits	PC	3	3	0	0	3
Theory cum Practical Courses								
1	21EC1503	Fundamentals of Electrical, Electronics and Communication	ES	5	3	0	2	4
2	21CS2501	Introduction to Computing using Python	ES	5	3	0	2	4
Practical Courses								
1	21EC2611	Semiconductor Devices and Circuits Laboratory	PC	4	0	0	4	2
			Total	23	14	1	08	**19**

21HS2101	ENGLISH FOR TECHNICAL COMMUNICATION	L	T	P	C
		2	0	0	2

Preamble

This course is offered to develop strategies and skills to enhance professional students' ability to read and comprehend engineering and technology texts. Foster their ability to write convincing job applications and effective reports. Develop their speaking skills to make technical presentations, participate in group discussions. The outcome of the course is to help students acquire the language skills of listening, speaking, reading and writing competency in English language thereby making them meet the global expectations.

Prerequisites for the course
- The prerequisite knowledge required to study this Course is the basic knowledge in English Language.

Objectives
1. To widen strategies and skills to augment ability to read and comprehend engineering and technology texts.
2. To draft convincing job applications and effective reports.
3. To develop speaking skills to make technical presentations, participate in group discussions.
4. To strengthen listening skills to comprehend technical lectures and talks in their areas of specialization.
5. To cultivate writing skills both technical and general.

MODULE 1	READING AND STUDY SKILLS	6

Reading - Reading longer technical texts and taking down notes – Note Making strategies; Writing - interpreting charts (all the types), graphs – comparing and contrasting statements/paragraphs – analysing technical details; Vocabulary Development - Select Technical Vocabulary; Language Development - Active Voice and Passive Voice

Suggested Activities	Evaluation Method
i) Visit to the Library - Reading articles on emerging trends and taking down notes in the prescribed format - Submission through FAST FORMS - Minimum 2 ii) Writing compare and contrast statements. (Eg. Windows 10 Vs Windows 1, RPA Developer Vs RPA Analyst, Edge Computing Vs Quantum Computing) related to the programme. iii) Teaching of Grammar Contents	i) Content & Structure ii) Submission: Fast form Document Submitted document will be assessed for a) Communication Etiquette b) Language Style c) Sentence Construction Activity iii will be assessed through Google form tests/ written tests.

MODULE 2	INTRODUCTION TO PROFESSIONAL WRITING	6

Reading - Technical related topics; Writing - purpose statements – extended definitions - writing instructions – checklists – recommendations – Minutes of the Meeting ; Vocabulary Development - select Technical Vocabulary ; Language Development - Subject Verb Agreement, Compound Words.

Suggested Activities	Evaluation Method
i) Visit to the Library - Reading articles on emerging trends and writing down purpose statements and extended definitions. Submission through FAST FORMS - Minimum 2 ii) Writing a set of 8 Instructions, Recommendations and Checklists for the suggested topics. (each 2 sets) iii) Teaching of Grammar Contents	i) Content & Structure ii) Submission: Fast form Document Submitted document will be assessed for a) Format b) Language Style c) Sentence Construction Activity iii will be assessed through Google form tests/ written tests.

MODULE 3	INTERVIEW SKILLS	6

Listening - Listening to mock Interviews ; Speaking - answering Interview questions – GD Strategies; Reading- longer texts both general and technical, practice in speed reading ; Writing - Job Application - Resume; Writing opinion paragraph - Writing paragraphs with reasons; Language Development - If – Conditionals

Suggested Activities	Evaluation Method

i) Listening to UPSC Toppers Mock Interviews.
 	
ii) Drafting Job application and Resume building.
 	
iii) Teaching of Grammar Contents
	i) Answering questions for Interview questions(Android app based)
	 Responses will be assessed for
	    a) Fluency
	    b) Communication etiquette
	    c) Language style
	 ii) Submission: Fast form Document
	 Submitted document will be assessed for
	a) Language Style
	b) Design
	 Activity iii will be assessed through Google form tests/

	written tests.	
MODULE 4	**REPORT WRITING I**	**6**

Writing - Fire accident Report, Industrial Visit Report, Project Report; Vocabulary Development-finding suitable synonyms - paraphrasing ; Language Development - Clauses.

Suggested Activities	Evaluation Method

i) Drafting reviews and reports on Industries -
  a) Profile & Products
  b) Trending technology adopted
  c) Careers
  d) Latest news
     Min - 2 Industries
ii) Teaching of Grammar Contents
	i) Content & Structure
	
	Activity ii will be assessed through Google form tests/ written tests.

MODULE 5	**REPORT WRITING II**	**6**

Writing - Writing Feasibility Reports, Survey Reports, Business Report; Vocabulary Development - verbal analogies ; Language Development - advanced use of Articles, Prepositional Phrases.

Suggested Activities	Evaluation Method

i) Drafting feasibility report on-
  a) Launching a new product / Technology
    Min - 2
ii) Teaching of Grammar Contents
	i) Content & Structure
	
	Activity ii will be assessed through Google form tests/ written tests.

	Total Periods	**30**

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	**Formative Assessment Test (10 Marks)**	**End Semester Exams (60 Marks)**
(i) Google Form based - on-line Test (ii) Written Test	(i) Google Form based - on-line Test incorporating Listening, Speaking and Reading	Written Test

Outcomes

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

CO1	Understand advanced technical texts from varied technical genres to understand engineering concepts and explore more.
CO2	Review technical contents written on par with international standards and rewrite contents using the right vocabulary without grammatical errors to make their articles published in reputed journals.
CO3	Articulate appropriately in interviews and Group Discussions effortlessly following the strategies expected by the corporate world.
CO4	Write reports utilizing the required format prescribed on par with international standards using the exact vocabulary to make their reports worthy to be read.
CO5	Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness.

Text Books

1. Mike Markrl. Technical Communication,Palgrave Macmillan: London, 2012.
2. Sumant,S and Joyce Pereira. Technical English II. Chennai: Vijay Nicole Imprints Private

Limited, 2014.
  3. Kumar, Sanjay and Pushp Lata. Communication Skills: A Workbook. New Delhi: OUP, 2018.

Reference Books
  1. Raman, Meenakshi & Sangeetha Sharma. Communication Skills. New Delhi: OUP, 2018
  2. Rizvi M, Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2007

Web Resources
  1. Interpretation of Charts : https://youtu.be/4lxA7lo9GLU : https://www.englishhints.com/charts-and-graphs.html
  2. Instructions https://www.wikihow.com/Write-Clear-Instructions
  3. Resume building https://novoresume.com/career-blog/how-to-write-a-resume-guide
  4. Report writing - https://www.youtube.com/watch?v=FXIuHOFAxos ; https://www.deakin.edu.au/students/studying/study-support/academic-skills/report-writing
  5. UPSC Interview: https://www.youtube.com/watch?v=OhJWg-0qdI0

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1				2						2	1	1		
2				2							2			
3							2		2	2				
4									2	2	2			
5									1	2	2	1		

Assessment Pattern

BLOOM'S CATEGORY	ASSESSMENT TESTS				END SEMESTER EXAMINATION
	CAT – 1	CAT -2	FAT - 1	FAT - 2	
REMEMBER	10	10	5	5	10
UNDERSTAND	30	30	10	10	30
APPLY	60	60	10	10	60
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0

SUGGESTED COURSE LEVEL ASSESSMENT QUESTIONS:
COURSE OUTCOME 1 (CO 1) : Understand advanced technical texts from varied technical genres to understand engineering concepts and explore more.
  1) Read the given passage and take notes.
  2) Analyse the given type of chart or graph and answer the questions given.
  3) Analyse the given chart or graph and write paragraphs comparing and contrasting the data.
  4) Analyse the given chart or graph and write paragraphs giving importance to technical

details.
   5) Fill in the blank with appropriate technical vocabulary.
   6) Convert the given active voice sentence into passive voice or impersonal passive voice.

COURSE OUTCOME 2 (CO 2) : Review technical contents written on par with international standards and rewrite contents using the right vocabulary without grammatical errors to make their articles published in reputed journals.
   1) Write a purpose statement for the tool or gadget given.
   2) Write an extended definition for the given word.
   3) Write 8 instructions / recommendations on the given topic.
   4) Write the Minutes of the meeting for the given meeting.
   5) Fill in the blank with appropriate Subject Verb agreement.
   6) Fill in the blank with suitable compound words.

COURSE OUTCOME 3 (CO 3) : Articulate appropriately in Interviews and Group Discussions effortlessly following the strategies expected by the corporate world.
   1) Listening to mock interviews and answering the questions.
   2) Listen to the strategies of GD and answer the given questions.
   3) Read and submit a recording of technical content following the strategies of speed reading.
   4) Write Job application with a cover letter for the given job description.
   5) Write paragraphs expressing opinion on the given topic.
   6) Fill in the blank / complete the sentence with appropriate If-Conditionals.

COURSE OUTCOME 4 (CO 4) : Write reports utilizing the required format prescribed on par with international standards using the exact vocabulary to make their reports worthy to be read.
   1) Write a fire accident report for the provided incident.
   2) Write an Industrial visit report.
   3) Write a report on the Project work undertaken by the candidate giving importance to the current status report and the time needed for the completion of the project.
   4) Find the appropriate synonym for the given word.
   5) Paraphrase the given passage.
   6) Fill in the blank with appropriate clauses.

COURSE OUTCOME 5 (CO 5) : Appraise the need for new products and write feasibility and survey reports following the format prescribed in a way to create awareness.
   1) Write a Feasibility report for a business / project proposal given.
   2) Write a survey report for the given scenario.
   3) Pick out the appropriate Verbal Analogy.
   4) Fill in the blank with appropriate articles.
   5) Complete the sentence with appropriate Prepositional Phrases.
   6) Choose the appropriate word to complete the sentence.

Concept Map

TECHNICAL COMMUNICATION

LISTENING
- Listening to mock Interviews.

READING
- Reading articles on emerging trends and taking notes.
- Technical topics.
- Longer texts both general and technical and practice speed reading.

LANGUAGE DEVELOPMENT
- Active Voice and Passive voice
- If – Conditionals
- Clauses
- Advanced use of Articles
- Prepositional Phrases.

SPEAKING
- Answering Interview questions.
- Participating in GD

WRITING
- Interoperation of charts and Graphs.
- Purpose Statements
- Extended Definitions
- Writing Instructions
- Checklists
- Recommendations
- Minutes of the Meeting
- Job Application & Resume
- Writing opinion paragraph
- Fire accident Report
- Industrial Visit Report
- Project Report
- Writing Feasibility Reports
- Survey Reports

VOCABULARY DEVELOPMENT
- Technical Vocabulary
- Subject Verb Agreement
- Compound Words
- Synonyms
- Paraphrasing
- Verbal Analogies

Course Content and Lecture Schedule

S. No	Topic	No of Hours required
MODULE - I (6 Hrs)		
1	Note Making strategies.	1
2	Note Making strategies - Reading longer technical texts and taking down notes.	1
3	Interpreting charts - types - comparing and contrasting.	1
4	Interpreting charts - write statements/paragraphs – analysing technical details.	1
5	Select Technical Vocabulary	1
6	Active Voice and Passive Voice	1
MODULE - II (6 Hrs)		
7	Reading Technical Topics	1
8	Purpose Statements – Extended Definitions	1
9	Checklists / Instructions	1
10	Recommendations	1
11	Minutes of the Meeting	1
12	Subject Verb Agreement, Compound Words.	1
MODULE - III (6 Hrs)		
13	Listening to mock Interviews.	1
14	Answering interview questions	1
15	Reading longer texts both general and technical, practice in speed reading	1

16	Job Application and Resume	1
17	Writing opinion paragraph	1
18	If – Conditionals	1
MODULE - IV (6 Hrs)		
19	Fire accident Report	1
20	Industrial Visit Report	1
21	Project Report	1
22	Finding Suitable Synonyms	1
23	Paraphrasing	1
24	Clauses	1
MODULE - V (6 Hrs)		
25	Feasibility Reports	1
26	Survey Reports	1
27	Reviewing Reports	1
28	Verbal Analogies	1
29	Advanced use of Articles	1
30	Prepositional Phrases	1

21MA2201	PARTIAL DIFFERENTIAL EQUATION AND APPLICATIONS OF FOURIER SERIES	L	T	P	C
		3	1	0	4

Preamble:
The course consists of topics in Complex Integration, Partial Differential Equations and Laplace Transforms with applications to various engineering problems. This course will cover the following main topics: Construction of analytic function, Taylors and Laurent's series, Poles and Residues, Half range sine series, Harmonic analysis, Fourier Series Solutions of one dimensional wave and heat flow equation and Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients.

Prerequisites for the course
Basic knowledge of Partial differentiation and Integration.

Objectives
1. To introduce to the concept of Analytical function
2. To familiarize with Complex integration
3. To introduce Fourier series analysis which is central to many applications in engineering field and its use in solving boundary value problems
4. To acquaint the student with PDE and Fourier series techniques in solving wave and heat flow problems used in various situations.
5. To improve the knowledge of Laplace transforms.

UNIT I	ANALYTIC FUNCTIONS	9+3

Definition of Analytic Function – Cauchy Riemann equations – Properties of analytic functions – Harmonic function – Harmonic Conjugate - Construction of analytic function by Milne Thomson's method and bilinear transformation.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Construction of analytic function by Milne Thomson's method and bilinear transformation.

UNIT II	COMPLEX INTEGRATION	9+3

Complex numbers and its conjugate - Cauchy's integral theorem (without proof) – Cauchy's

integral formulae and its higher order derivatives (without proof) and its applications – Taylors and Laurent's series – Types of Singularities – Poles and Residues – Cauchy's residue theorem (without proof).

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Taylors series, Laurent's series and Cauchy's residue theorem.

UNIT III	FOURIER SERIES	9+3

Dirichlet's conditions – General Fourier series – Change of Intervals - Odd and even functions – Half range sine series – Half range cosine series - Root mean square value – Harmonic analysis for Fourier series - Engineering Applications.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Fouries series of Odd and even functions, Half range sine and cosine series, Harmonic analysis.

UNIT IV	PDE AND APPLICATIONS OF FOURIER SERIES	9+3

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – Fourier Series Solutions of one dimensional   equation of heat conduction - Engineering Applications.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Fourier Series Solutions of one dimensional wave equation and heat conduction equation.

UNIT V	LAPLACE TRANSFORMS	9+3

 Properties of Laplace Transform – Inverse transforms – Convolution theorem (Without Proof) – Partial fraction - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients only - Engineering Applications.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Laplace transform using partial fraction, Convolution theorem and solving ODE.

	Total Periods	**45 + 15 = 60 Periods**

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
1. Descriptive Questions	1.Assignment 2. Online Quizzes	1. Descriptive Questions

Outcomes

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

CO1: Apply Cauchy-Riemann equations to problems of fluid mechanics, thermodynamics and electro-magnetic fields. (Apply)

CO2: Solve complex valued integral functions using residues.   (Apply)

CO3: Construct the Fourier series expansion of the periodic function.   (Apply)

CO4: Solve the problems of one dimensional wave and heat equation.   (Apply)

CO5: Apply Laplace Transform technique to solve the given ordinary differential equation. (Apply)

Text Books

1. B. S. Grewal, " Higher Engineering Mathematics", 45rd edition, 2017.
2. Kreyszig.E, "*Advanced Engineering Mathematics*", John Wiley & Sons. Singapore, 15th edition, 2017.

Reference Books

1. A Textbook of Engineering Mathematics(Dr. A.P.J. Abdul Kalam Technical University,

Lucknow) (For . Gautam Bhudh technical Universities ,Lucknow) January 2020
2. Advanced Engineering Mathematics , H. K. DASS, S. CHAND and Company Limited, New Delhi, 22nd revised edition, 2018.

Web Resources
1. Analytic functions - https://youtu.be/8jPr6rGstYk
2. Complex Integration - https://youtu.be/4yC4IXcMKJg
3. Fourier series - https://youtu.be/LGxE_yZYigI
4. Applications of fourier series - https://youtu.be/YfGHNdVeyB4
5. Laplace Transform - https://youtu.be/c9NibpoQjDk

CO Vs PO Mapping and CO Vs PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	2												
2	3	2												
3	3	2										2		
4	3	2										2		
5	3	2												

ASSESSMENT PATTERN:

BLOOM'S CATEGORY	ASSESSMENT TESTS				END SEMESTER EXAMINATION
	CAT – 1	CAT -2	FAT - 1	FAT – 2	
REMEMBER	10	10	5	5	10
UNDERSTAND	30	30	10	10	30
APPLY	60	60	10	10	60
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1 (CO 1) : (Apply)
1. Construct an analytic function whose imaginary part is $v = e^x(x\cos y - y\sin y)$
2. Find the bilinear transformation that maps the points Z =0, -1 ,i on to the points $i, 0, \infty$.

COURSE OUTCOME 2 (CO 2) : (Apply)

1) Solve $\int \frac{e^{2z}}{(z+1)^4} dz$ using Cauchy's Integral formula where C is $|z| = 2$.

2) Compute $\int \frac{2z-1}{z(z+1)(z-3)} dz$ using Cauchy's Residue theorem where C is $|z| = 2$.

COURSE OUTCOME 3 (CO 3) : (Apply)
1) Construct Fourier series for $f(x) = x$ in $(-\pi, \pi)$.
2) Construct Fourier series for $f(x) = x^2$ in $(-l, l)$.

COURSE OUTCOME 4 (CO 4) : (Apply)
1) Identify the PDE $u_{xx} = a^2 u_{tt}$

2) A tightly stretched string with fixed end points $x = 0, x = l$ is initially at rest in its equilibrium position. If it is vibrating, giving each point a velocity $\lambda x(l - x)$. Find the displacement of the string at any time 't'.

COURSE OUTCOME 5 (CO 5) : (Apply)

1) Solve $\frac{d^2x}{dt^2} - 3\frac{dx}{dt} + 2x = 2$, given $x = 0$ and $\frac{dx}{dt} = 5$ for $t = 0$ using Laplace transform method.

2) Find the Laplace transform for $\frac{\cos at - \cos bt}{t}$.

21EC2601	SEMICONDUCTOR DEVICES AND CIRCUITS	L	T	P	C
		3	0	0	3

Prerequisites for the course

- Fundamentals of Electrical, Electronics and Communication

Preamble

A network refers to any interconnected set of objects. An "electrical network" is an interconnection of electrical elements (Active and Passive) such as resistors, inductors, capacitors, transformers, diodes, sources, controlled sources and switches. Passive networks have interconnection of elements which cannot generate energy but can dissipate or stored energy. All electrical and electronic devices can be represented by electric circuits. So formulation of equivalent circuit and the study of behaviour of the network is formulated by analyzing the equivalent circuit with network laws and theorem.

It deals with a discussion on how electron energy bands are formed in semiconductors; followed by discussions on equilibrium statistics of electrons and holes, drift, diffusion currents, and generation and recombination processes. It then examines the principles and operations of essential semiconductor devices used in today's electronics: diodes, light detectors and emitters, bipolar junction transistors and MOSFETs. It includes analysis of small signal model and large signal model of the devices which is the prerequisite for next level courses. The goal is to develop a solid understanding of the device concepts that will be needed in a broad range of areas from semiconductor to circuit (analog, digital and VLSI) design and engineering.

UNIT I	CIRCUIT ANALYSIS	9

Introduction– voltage and current division, source transformation -Mesh current and node voltage method of analysis for D.C. circuits, Network theorems -Superposition theorem, Thevenins theorem, Norton's theorem, Reciprocity theorem, and Maximum power transfer theorem

UNIT II	RESONANCE AND TRANSIENT CIRCUITS	9

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits. Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT III	BIPOLAR JUNCTION TRANSISTOR	9

Introduction-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, Breakdown in Transistors.

UNIT IV	FET AND DISPLAY DEVICES	9

Principle of operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET. Display Devices - SCR, DIAC, TRIAC, LED, LCD, Photo transistor, Opto Coupler, Solar cell.

UNIT V	SPECIAL SEMICONDUCTOR DEVICES	9

Metal-Semiconductor Junction- MESFET, FINFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode-PIN Diode, LASER diode, LDR.

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers- CAT-1, CAT-2	• MCQ • Assignment • Tutorials	• Descriptive Answers

Outcomes

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

CO1	Analyze and interpret the basic laws for AC and DC circuits
CO2	Design and analyze the Resonance and transient circuits.
CO3	Comprehend the structure of the Transistor configurations and Interpret the different models of transistor.
CO4	Analyze and interpret the Field Effect Transistors and Display Devices
CO5	Apply and use the special semiconductor devices.

Text Books

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2017)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2011).

Reference Books

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits", Tata McGraw Hill, 2nd Edition, 2008.

Web Resources

1. https://youtu.be/XEleaNLC1LY (Reciprocity Theorem)
2. https://www.youtube.com/watch?v=Oc9qXwXuW3s (Single Tuned Circuits)
3. https://www.youtube.com/watch?v=LktdcR9IcZo (Gummen-Pool Model)
4. https://www.youtube.com/watch?v=95w7YdIEYQY (Thermal effect on MOSFET)
5. https://www.youtube.com/watch?v=1oRJf54zBRU (LASER Diode)

CO Vs PO Mapping and CO Vs PSO Mapping

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

2	3	3		3								2	
3	3	3		2								2	
4	3	3										2	
5	3	3										2	

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	20	20	20	20
UNDERSTAND	40	40	20	20	40
APPLY	20	20	30	30	20
ANALYZE	20	20	10	10	20
EVALUATE					
CREATE					
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS
 COURSE OUTCOME 1:
   1. Frame nodal equation for the network given and hence identify the potential difference at nodes (Apply)
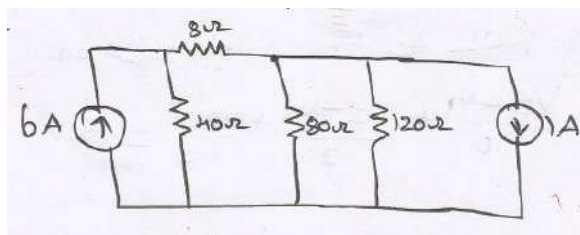
   2.   Determine Vo using Norton's Theorem (Understand)
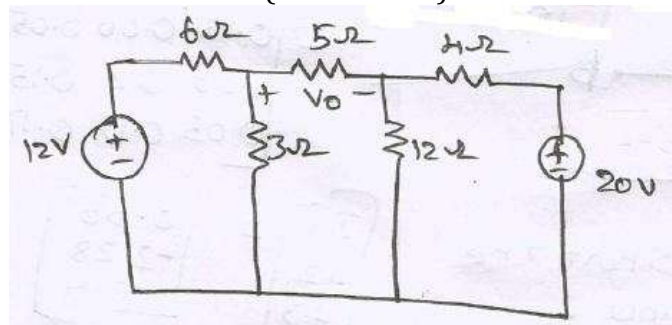
COURSE OUTCOME 2:

1. For a Series RL circuit, Derive the condition of Response for an A.C input. (Understand)
2. For a Series RLC circuit, Derive the condition of Response for an D.C input. (Understand)

COURSE OUTCOME 3:
1. Derive and analyze the expression for current gain, input impedance and voltage gain of a CE Transistor Amplifier. (Analyze)
2. Formulate the expression of Gummel Poon-model with neat circuit diagram (Apply)

COURSE OUTCOME 4:
1. Identify and formulate the differences between BJT and FET. (Understand)
2. Demonstrate in detail the modes of operation of SCR and Solar Cells (Apply)

COURSE OUTCOME 5:
1. Investigate the Tunnel diode with neat principle of operation and its Equivalent circuit (Analyze)
2. Describe the construction details and working principle of LASER diode. (Understand)

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with POs
	UNIT I - CIRCUIT ANALYSIS		
1	Introduction- Circuit Elements in series and parallel	1	1,2
2	Voltage division and current division	2	1,2,4
3	Mesh current and node voltage method of analysis for D.C circuits	2	1,2,4
4	Superposition theorem	1	1,2,4
5	Thevenins theorem, Nortons theorem,	1	1,2,4
6	Reciprocity theorem	1	1,2,4
7	Maximum power transfer theorem, application of Network theorems	1	1,2,4
	UNIT 2-RESONANCE AND TRANSIENT CIRCUITS		
8	Series and parallel resonance – their frequency response	2	1,2,4
9	Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling	3	1,2
10	Tuned circuits – Single tuned circuits	1	1,2,4
11	Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.	3	1,2,4
	UNIT 3- BIPOLAR JUNCTION TRANSISTOR		

12	Introduction-NPN -PNP -Operations-Early effect-Current equations–,	2	1,2,4
13	Input and Output characteristics of CE, CB, CC	2	1,2
14	Hybrid -π model – h-parameter model,	2	1,2,4
15	Ebers Moll Model- Gummel Poon-model	2	1,2,4
16	Breakdown in Transistors.	1	1,2
UNIT 4-FET AND DISPLAY DEVICES			
17	Principle of operation and comparison of N-Channel and P-Channel JFET	2	1,2
18	drain current equation – MOSFET – Enhancement and depletion types – structure and operation	2	1,2
19	Comparison of BJT with MOSFET – thermal effect on MOSFET.	2	1,2
20	Display Devices - SCR, DIAC, TRIAC, LED, LCD	2	1,2
21	Photo transistor, Opto Coupler, Solar cell.	1	1,2
UNIT 5-SPECIAL SEMICONDUCTOR DEVICES			
22	Metal-Semiconductor Junction- MESFET,	1	1,2
23	FINFET, DUAL GATE MOSFET	2	1,2
24	Schottky barrier diode-Zener diode-Varactor diode	3	1,2
25	Tunnel diode-PIN Diode, LASER diode, LDR	3	1,2

		L	T	P	C
21EC1503	**FUNDAMENTALS OF ELECTRICAL, ELECTRONICS AND COMMUNICATION**	**3**	**0**	**2**	**4**

Prerequisites for the course
- Fundamentals of Electrical, Electronics and communication

Preamble
- This course aims to equip the students with an understanding of the fundamental principles of electrical engineering and provide an overview of evolution of electronics, and introduce the working principle and examples of fundamental electronic devices and digital circuits and basic principles of Electrical Machines .This course also provides an overview of evolution of communication systems, and introduce the basic concepts in digital communication.

UNIT I	ELECTRICAL FUNDAMENTALS	8

Dc Circuits: Terminologies, Ohms law, Kirchhoff's laws, Series- parallel circuits, voltage & current division. *Ac Circuits:* Single Phase RL, RC, RLC Series circuits, Three Phase Systems, Star and

Delta Connection- Electrical Safety Fuses and Earthing

UNIT II	PN JUNCTION DIODE	8

PN Junction Diode: Energy bandgap, Pn junction Diode, Drift & Diffusion of carriers, Diode Current equations, forward and reverse characteristics, Switching Characteristics. Zener Diode-Characteristics, Breakdown mechanism in pn junction diode and zener diode.

UNIT III	APPLICATIONS OF DIODE AND DIGITAL SYSTEMS	8

Diode Applications: Rectifier circuits- Halfwave and Fullwave Rectifier, Zener voltage Regulator, Diode Clipper and Clamper circuits.
Digital Systems: Binary, Octal and Hexadecimal number System, Logic gates, Introduction of R-S, J-K, D and T Flip Flops & its truth tables

UNIT IV	ELECTRICAL MACHINES	8

Construction, Working Principle, emf & torque equation and applications of DC Machines, Transformers-single phase and Three Phase, Single phase and Three-phase Induction motors

UNIT V	INTRODUCTION TO COMMUNICATION	8

Introduction: Need and Importance of Communication, Elements of a Communication System, Types of communication systems - Electromagnetic Spectrum used in communication, concept of bandwidth and power, Need for modulation and types.
Analog Modulation: Amplitude modulation, AM-DSBFC-Waveform, Characteristic equation. Angle Modulation, Definition, Types, FM and PM Waveform Digital Modulation. – Review of sampling – Quantization.

	Total Periods	40

LABORATORY

S.NO	NAME OF THE EXPERIMENTS	HOURS	CO
1.	Verification Of Ohm's Law And Kirchoff's Laws	2 hours	1
2.	Effect Of Series And Parallel Resistance In A Dc Circuit	2 hours	1
3.	Design A Circuit To Measure The Cut-In And Reverse Breakdown Voltages Of A PN junction Diode.	2 hours	2
4.	Design A Circuit To Measure The Cut-In And Regulation Region Voltages Of A Zener Diode	2 hours	2
5.	Measurement Of AC Signal Parameter (Amp, Time, Freq, Peak-To-Peak, Rms, Avg)	2 hours	3
6.	Study of Logic Gates and verify its truth table.	2 hours	3
7.	Construct and validate the Step-Up /Step-Down behavior of the transformer	2 hours	4
8.	Study the construction of single phase transformer.	2 hours	4
9.	Generate amplitude modulated wave and determine the percentage modulation.	2 hours	5
10.	Generate frequency modulated wave and determine the percentage modulation	2 hours	5
	Total Periods	20	

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers-CAT-1, CAT-2	• Lab Experiment • Lab Model exam	• Descriptive Answers

Outcomes

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

CO1	Concern fundamental concepts and circuit laws to solve simple DC electric circuits
CO2	illustrate the basic principles of PN Junction Diode
CO3	Analyze the application of Diode and Digital systems
CO4	Outline the principle of an Electrical Machines
CO5	Enlighten the principle of Analog and digital communication

Text Books

1. S. Salivahanan, R. Rengaraj,G. R. Venkatakrishnan,"Basic Electrical, Electronics and Measurement Engineering ,McGraw Hill Education (India) Private Limited 1st Edition 2018
2. Abhijit Chakrabarti ,Sudipta Debnath, "Basic Electrical and Electronics Engineering-I" McGraw Hill Education (India) Private Limited Fifth Edition 2015
3. Shuqin Lou, Chunling Yang," Digital Electronic Circuits: Principles and Practices" De Gruyter, 2019 Edition.
4. John G.Proakis Masoud Salehi,"Fundamentals of communication systems "Prentice Hall, 2nd Edition 2015.

Reference Books

1. R Muthusubramanian, S Salivahanan, ' Basic Electrical and Electronics Engineering', McGraw Hill Publisher
2. S Salivahanan, 'Electronic Devices'. McGraw Hill -2018 edition
3. Wayne Tomasi,' Electronic Communication Systems: Fundamentals through Advanced, 5th dition, Pearson Publisher.

Web Resources

* https://onlinecourses.nptel.ac.in/noc19_ee35/preview
* https://nptel.ac.in/courses/108106177
* https://nptel.ac.in/courses/117102059

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3.2	1.8	2			0.5						0.5		
2	5.5		2.5											
3	3.5	2		2.5										
4	4	3										1		
5	4	2										2		

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	Lab Experiment	Lab Model Exam	END SEM EXAM
REMEMBER	20	20			
UNDERSTAND	20	20			
APPLY	30	40	50	50	50
ANALYZE	30	20	50	50	50
EVALUATE					

CREATE					
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. With the help of RL circuits estimate the resonance frequency for the circuit (Apply)
2. Enumerate the precautionary steps in regard with Electrical Safety? (Apply)

COURSE OUTCOME 2:
1. Estimate the characteristics curve of a diode with relevant diagrams. (Understand)
2. Draw and explain the characteristics curve of a diode with relevant diagrams (Understand).

COURSE OUTCOME 3:
1. Derive and analyse half wave rectifier parameter along with the performance equations. (analyse).
2. Convert the $(2345)_{10}$ in to equivalent decimal, octal and hexa decimal values. (analyse).

COURSE OUTCOME 4:
1. Construct the single phase induction motor and its working principle with relevant sketches. (Analyse)
2. Develop the torque equation of DC motor and its working principle with relevant sketches. (Analyse)

COURSE OUTCOME 5:
1. Draw the block diagram of essential Elements of a Communication System and its role. (Understand)
2. Interpret the importance of carrier signal in amplitude modulation and significance of modulation index with various values. (Understand)

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with POs
	UNIT I - ELECTRICAL FUNDAMENTALS		
1	Terminologies, Ohms law, Kirchhoff's laws, Series- parallel circuits, voltage & current division	2	1,2,3,12
2	Single Phase RL, RC, RLC Series circuits	2	1,2,3
3	Three Phase Systems	2	1,2,3
4	Star and Delta Connection-	1	1,2,3
5	Electrical Safety Fuses and Earthing,	1	1,6
	UNIT-II PN JUNCTION DIODE		
6	Energy bandgap, Pn junction Diode, Drift & Diffusion of carriers	2	1,3
7	Diode Current equations,	1	1
8	forward and reverse characteristics	2	1

9	Switching Characteristics	1	1
10	Zener Diode- Characteristics	1	1,3
11	Breakdown mechanism in pn junction diode and zener diode	1	1
UNIT-III APPLICATIONS OF DIODE AND DIGITAL SYSTEMS			
12	Rectifier circuits- Halfwave and Fullwave Rectifier	2	1,2,3
13	Zener voltage Regulator	1	1
14	Diode Clipper and Clamper circuits.	1	1,2
15	Binary, Octal and Hexadecimal number System	1	1,2
16	Logic gates	1	1,2
17	Introduction of R-S, J-K, D and T Flip Flops & its truth tables	2	1,4
UNIT-IV ELECTRICAL MACHINES			
18	Construction, Working Principle, emf & torque equation	2	1,2,12
19	Applications of DC Motor , DC Machines, Transformer	1	1,2
20	Single phase Transformer	1	1,2
21	Three Phase Transformers	1	1,2
22	Single phase Induction motor	2	1,2,12
23	Three phase Induction motor	1	1,2
UNIT-V INTRODUCTION TO COMMUNICATION			
24	Need and Importance of Communication, Elements of a Communication System, Types of communication systems - Electromagnetic Spectrum used in communication, concept of bandwidth and power, Need for modulation and types.	2	1,2,12
25	Amplitude modulation, AM-DSBFC-Waveform, Characteristic equation	2	1,2,12
26	Angle Modulation, Definition, Types, FM and PM Waveform Digital Modulation	2	1,2,12
27	Review of sampling – Quantization	2	1,2,12

		L	T	P	C
21CS2501	**INTRODUCTION TO COMPUTING USING PYTHON (Common for AI&DS,CSE,CSBS,ECE,EEE,IT)**	**3**	0	2	4
Preamble					

This course provides learners an insight into Python programming, and develop programming skills to manage the development of software systems. It covers programming environments, important instructions, data representations, intermediate level features, image processing, exception handling and file data processing of Python.

Prerequisites for the course
- Problem Solving Techniques, Logical Thinking

Objectives
1. To know the features of Python.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and use function calls.
4. To use Python data structures – strings, lists, tuples, dictionaries.
5. To work with files in Python.
6. To work with images.

UNIT I	INTRODUCTION TO PYTHON PROGRAMMING	4

Introduction to Python Programming – Python Interpreter and Interactive Mode – Variables and Identifiers – Arithmetic Operators– Values and Types – Statements - Operators – Boolean Values – Operator Precedence – Expression - Conditionals: if, if-else, if elif else Constructs

UNIT II	LOOPS, FUNCTIONS AND LISTS	6

Loop Structures/Iterative Statements –Loop Control Statements – List – Adding Items to a List – Finding and Updating an Item – Nested Lists –List Concatenation – List Slices – List Methods – List Loop – Mutability. Function Call and Returning Values – Fruitful Function – Parameter Passing – Local and Global Scope – Recursive Functions.

UNIT III	STRING, ARRAYS, TUPLES	7

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built-In String Functions. –Using Arrays with Numpy: Vectors and operations - vector properties and characteristics, Pandas - Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value.

UNIT IV	DICTIONARY, FILES	6

Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built-in Dictionary Function – Finding Key and Value in a Dictionary.
Introduction to Files – File Modes – Opening and Closing Files – Reading and Writing Files

UNIT V	EXCEPTION HANDLING, IMAGE PROCESSING	7

Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.
Image Processing - Image File Formats, Image-Manipulation Operations, The Properties of Images, Python Image Library(PIL)- Converting an Image to Black and White/Grayscale, Blurring an Image, Edge Detection and Reducing the Image Size.

	Total Periods	30 Theory +30 Lab

Laboratory Requirements
- 60 Systems with windows / LINUX operating system with python IDLE or equivalent.

Suggestive Assessment

Continuous Assessment Test (30 Marks)	Lab Components Assessments (20 Marks)	End Semester Exams (50 Marks)
1. DESCRIPTIVE QUESTIONS	1. LAB EXPERIMENTS 2. MODEL EXAMINATION	1. DESCRIPTIVE QUESTIONS

Outcomes

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

CO1: Write Python programs for solving problems using conditional statements.
CO2: Write Python programs for solving problems using looping statement and list and decompose a Python program into functions.
CO3: Represent data using Python strings, arrays, tuples, dictionaries and solve computational problems using them and use Numpy and Pandas libraries in real time applications.
CO4: Develop programs to read and write data from/to files in Python and handle exceptions while dealing with data.
CO5: Apply the power of graphics for processing images.

Text Books
1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", Second Edition,Shroff/O'Reilly Publishers, 2016

Reference Books
1. Charles Dierbach, "Introduction to Computer Science using Python", Wiley India Edition, 2016.

Web Resources
1. Python for Data science - https://onlinecourses.nptel.ac.in/noc20_cs36/course (Unit III – Numpy, Pandas)
2. https://www.geeksforgeeks.org/image-processing-in-python-scaling-rotating-shifting-and-edge-detection/ (Unit V)

List of experiments

S.NO	NAME OF EXPERIMENTS	CO
1	Basic Python Programming a) Alice buys a toy with a selling price of 100 rupees. There is a discount of x percent on the toy. Develop a python program to find the amount Alice needs to pay for it.	**CO1**
2	Python Programs using conditionals – if, if – else, if – elif – else statements b) Write a program that takes cost price and selling price as input and displays whether the transaction is a **Profit** or a **Loss** or **Neither.** a) Chef considers the climate HOT if the temperature is **above** 2020, otherwise he considers it COLD. You are given the temperature *C*, write a python program to find whether the climate is HOT or COLD. b) Write a Python Program to read the unit of electricity consumed in a house and calculate the amount to be paid for the electricity consumed. The bill amount should be calculated as per the given specification: a. For 0 to 100 units the per unit is ₹ 0/- b. For 0 to 200 units, for the first 100 unit the per unit cost is zero and the next 100 units, the consumer shall pay ₹ 1.5 per unit. c. For 0 to 500 units, the consumer shall pay ₹ 0 for the first 100 units, for the next 100 units the consumer shall pay ₹ 2 per unit, for the next 300 units the unit cost is ₹3.00/-	CO1

| 3 | Python Programs using looping statements
a) Implement Python Script to generate first N natural numbers.
b) Implement Python Script to check given number is palindrome or not.
c) Implement Python script to print factorial of a number.
d)Implement Python Script to check given number is Armstrong or not.
e) Square the Digits :
Given a two digit number, calculate the sum of square of the digits. Repeat the same for the output till any of the number in series repeats. Output should be the first number that repeats in the process.
Sample :
Input :
13
Explanation : ('^' denotes power in this explanation)
Step 1 : 1^2 + 3^2 = 1 + 9 = 10
Step 2 : 1^2 + 0^2 = 1 + 0 = 1
Step 3: 1^2 = 1
1 repeats hence output should be "1"
Output:
1
Input:
7
Explanation:
Step 1 : 7 ^2 = 49
Step 2 : 4^2 + 9^2 = 16 + 81 = 97
Step 3 : 9^2 + 7^2 = 81 + 49 = 130
Step 4: 1^2 + 3^2 + 0^2 = 1+ 9 + 0 = 10
Step 5 : 1^2 + 0^2 = 1 + 0 = 1
Step 6: 1^2 = 1
1 repeats hence output should be "1"
Output:
1 | CO2 |

4	Python Programs using Functions a) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000. b) Have the function CodelandUsernameValidation(**str**) take the **str** parameter being passed and determine if the string is a valid username according to the following rules: 1. The username is between 4 and 25 characters. 2. It must start with a letter. 3. It can only contain letters, numbers, and the underscore character. 4. It cannot end with an underscore character. If the username is valid then your program should return the string **true**, otherwise return the string **false**. **Examples** Input: "aa_" Output: falseInput: "u_hello_world123" Output: true	CO2

| 5 | Python Programs using List
a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55, 33, 12, 98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34',67', '55', '33', '12', '98').
b) In this program, create a list of numbers from 1 to 50 named **list_1**. The numbers should be present in the increasing order: Ex **list_1 = [1,2,3,4,5,....,50]** i.e. index zero should be 1, index one should be 2, index two should be 3 and so on. Given an input let's say **a**, you have to print the **number** of elements of **list_1** which are divisible by **a, excluding** the element which is equal to **a. Input:** Number **a Output:** In a single line, the number of elements (i.e. the count and not the elements) which are divisible by **a. Example: Input: 24 Output: 1**
c) In this program, create a list of numbers from 1 to 50 named **list_1**. The numbers should be present in the increasing order: Ex **list_1 = [1,2,3,4,5,....,50]** i.e. index zero should be 1, index one should be 2, index two should be 3 and so on. Given an input let's say **a**, you have to print the **number** of elements of **list_1** which are divisible by **a, excluding** the element which is equal to **a. Input:** Number **a Output:** In a single line, the number of elements (i.e. the count and not the elements) which are divisible by **a**. Example: Input: 24 Output: 1
d) Given a list l of size N and two elements x and y, use counter variables to find which element appears most in the list, x or y. If both elements have the same frequency, then return the smaller element. Write a Python program to implement the above said statement.
 Note: We need to return the element, not its count.
 Example 1:
Input:
N = 11
l = [1,1,2,2,3,3,4,4,4,4,5]
x = 4, y = 5
Output: 4
Explanation:
frequency of 4 is 4.
frequency of 5 is 1.
Example 2:
Input: N = 8 l = [1,2,3,4,5,6,7,8] x = 1, y = 7 **Output: 1**
Explanation: frequency of 1 is 1. frequency of 7 is 1.
Since 1 < 7, return 1. | CO3 |

| 6 | Python Programs using String, Tuples, Numpy array and Pandas.
a)Accepts a string and calculate the number of upper case letters and lower case letters.
b)Write a python program to check whether the given string is palindrome or not.
c)Create all possible strings by using 'a', 'e', 'i', 'o', 'u'. Use the characters exactly once.
d) Python Program to Sort a List of Tuples in Increasing Order by the Last Element in Each Tuple
e) Use mtcars.csv dataset do the following:
            What is the type of each variable of the mtcars data set?
    o Divide the column that has the car name into columns that contain the make and model of the car.
    o Do all observations have a make and model value? If there are missing values, can you fix them? (Hint, use Google to help you.)
    o Some car companies have more than one make. In this data Chrysler, Plymouth, and Dodge were all made by Chrysler. Likewise Cadillac and Pontiac are made by GM and Lincoln and Ford are both made by Ford. Create a company variable based on the data in the make variable
    o Create a name for use in displaying results that is a character string composed of make, a space character, if the company name is not the same as the make then the company in parentheses (), and model. | CO3 |

	f) Write a python program to sort the DataFrame first by 'name' in descending order, then by 'score' in ascending order. **Sample Python dictionary data and list labels:** exam_data = {'name': ['Anastasia', 'Dima', 'Katherine', 'James', 'Emily', 'Michael', 'Matthew', 'Laura', 'Kevin', 'Jonas'],'score': [12.5, 9, 16.5, np.nan, 9, 20, 14.5, np.nan, 8, 19],'attempts': [1, 3, 2, 3, 2, 3, 1, 1, 2, 1],'qualify': ['yes', 'no', 'yes', 'no', 'no', 'yes', 'yes', 'no', 'no', 'yes']} labels = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j'] Values for each column will be: name : "Suresh", score: 15.5, attempts: 1, qualify: "yes", label: "k" **Expected Output: Orginal rows:**	
	<table><tr><td></td><td>name</td><td>score</td><td>attempts</td><td>qualify</td></tr><tr><td>a</td><td>Anastasia</td><td>12.5</td><td>1</td><td>yes</td></tr><tr><td>b</td><td>Dima</td><td>9.0</td><td>3</td><td>no</td></tr><tr><td>c</td><td>Katherine</td><td>16.5</td><td>2</td><td>yes</td></tr><tr><td>d</td><td>James</td><td>NaN</td><td>3</td><td>no</td></tr><tr><td>e</td><td>Emily</td><td>9.0</td><td>2</td><td>no</td></tr><tr><td>f</td><td>Michael</td><td>20.0</td><td>3</td><td>yes</td></tr><tr><td>g</td><td>Matthew</td><td>14.5</td><td>1</td><td>yes</td></tr><tr><td>h</td><td>Laura</td><td>NaN</td><td>1</td><td>no</td></tr><tr><td>i</td><td>Kevin</td><td>8.0</td><td>2</td><td>no</td></tr><tr><td>j</td><td>Jonas</td><td>19.0</td><td>1</td><td>yes</td></tr></table> Sort the data frame first by 'name' in descending order, then by 'score' in ascending order: <table><tr><td></td><td>name</td><td>score</td><td>attempts</td><td>qualify</td></tr><tr><td>a</td><td>Anastasia</td><td>12.5</td><td>1</td><td>yes</td></tr><tr><td>b</td><td>Dima</td><td>9.0</td><td>3</td><td>no</td></tr><tr><td>c</td><td>Katherine</td><td>16.5</td><td>2</td><td>yes</td></tr><tr><td>d</td><td>James</td><td>NaN</td><td>3</td><td>no</td></tr><tr><td>e</td><td>Emily</td><td>9.0</td><td>2</td><td>no</td></tr><tr><td>f</td><td>Michael</td><td>20.0</td><td>3</td><td>yes</td></tr><tr><td>g</td><td>Matthew</td><td>14.5</td><td>1</td><td>yes</td></tr><tr><td>h</td><td>Laura</td><td>NaN</td><td>1</td><td>no</td></tr><tr><td>i</td><td>Kevin</td><td>8.0</td><td>2</td><td>no</td></tr><tr><td>j</td><td>Jonas</td><td>19.0</td><td>1</td><td>yes</td></tr></table>	
7	Python Programs using Dictionary a)Create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4)change values 5) use len() b) Write a Python Program to multiply all the items in a dictionary.	CO3
8	Python Programs using Files a) Write Python script to display file contents. b) Write Python script to copy file contents from one file to another. c) Write a Python program to count the number of lines, words, letters, blank spaces in a file.	CO4

9	Python Programs using Exceptions Write a Python program to solve the following: (Use Exception Handling) You are given a string . Your task is to find out whether is a valid regex or not. **Input Format** The first line contains integer , the number of test cases. The next lines contains the string . **Constraints:** 0<T<100 **Output Format** Print "True" or "False" for each test case without quotes. **Sample Input** 2 .*\+ .*+ **Sample Output** True False **Explanation** .*\+ : Valid regex. .*+: Has the error multiple repeat. Hence, it is invalid.	CO4
10	Calculation of the Area : Don't measure Monte Hall : 3 doors and a twist Sorting : Arrange the books	CO2
11	Searching : Find in seconds Anagram Lottery Simulation - Profit or Loss	CO2
12	Simulate a password generator Simulate a grade book for a teacher Rock Paper and Scissor.	CO2
13	Python Program for: Converting an Image to Black and White/Grayscale Blurring an Image, Edge Detection and Reducing the Image Size	CO5

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	2	1	1									3
2	1	2	1	1	1									3
3	1	2	1	1	1									3
4	1	1	1	2	1									2
5	2	2	2	2	1									2

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	Lab Components	Model Exam	END SEM EXAM
REMEMBER	10	10			10
UNDERSTAND	10	10			20
APPLY	80	80	100	100	70
ANALYZE					
EVALUATE					
CREATE					

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:

1. Write a Python Program to read the unit of electricity consumed in a house and calculate the amount to be paid for the electricity consumed. The bill amount should be calculated as per the given specification:
   a. For 0 to 100 units the per unit is ₹ 0/-
   b. For 0 to 200 units, for the first 100 unit the per unit cost is zero and the next 100 units, the consumer shall pay ₹ 1.5 per unit.
   c. For 0 to 500 units, the consumer shall pay ₹ 0 for the first 100 units, for the next 100 units the consumer shall pay ₹ 2 per unit, for the next 300 units the unit cost is ₹3.00/-   (Apply)

2. Chef and Chefina are at positions X and Y on a number line. They both love badminton. It is known that badminton courts are located at every integer point. They want to find a court such that the maximum distance travelled by either of them is **minimized**. Formally, suppose they choose the badminton court at position Z. You need to find the minimum value of $\max(|X-Z|, |Y-Z|)$ across all possible choices of Z. Here, |X| denotes absolute value of X. Write a Python Program to Report this minimum value.

Input Format

The first line of input will contain a single integer T, denoting the number of test cases.

Each test case consists of two space-separated integers X and Y.

Output Format

For each test case, output the minimum possible value of $\max(|X-Z|, |Y-Z|)$.

Constraints

$1 \le T \le 1000$

$1 \le X, Y \le 1000$

$X <= Y$

Sample :

Input

4

3 5

7 6

1 10

Output

1

1
5
16
3. Develop a Python Program to Check if a Date is Valid and Print the Incremented Date if it is.
(Apply)

COURSE OUTCOME 2:
1. Write a Python Program to Read a Number n and Compute n+nn+nnn. (Apply)
2. Write a program to find Sum of Digit of a Number using Recursion in Python. (Apply)
3. Differentiate break and continue. (Understand)

COURSE OUTCOME 3:
1. What is printed by the following statements?   (Apply)
   ```
   s = "engineering"
   r = ""
   for item in s:
           r = item.upper() + r
   print(r)
   ```
2. Is string is mutable. Justify your answer.   (Understand)
3. Write a Python Program to count the number of lowercase letters and uppercase letters in a string.   (Apply)

COURSE OUTCOME 4:
1. What happens if the file is not found in the following Python code?   (Apply)
   ```
   a=False
   while not a:
   try:
           f_n = input("Enter file name")
           i_f = open(f_n, 'r')
   except:
           print("Input file not found")
   ```
2. Write a Python Program that Reads a Text File and Counts the Number of Times a Certain Letter Appears in the Text File.   (Apply)
3. Write a Python Program to Extract Numbers from Text File.   (Apply)
4. Write a Python Program to merge two files into a third file.   (Apply)

COURSE OUTCOME 5:
1. Write a python program to convert RGB image to Black and white Image. (Apply)
2. How will you handle exception when it is raised? Explain.   (Understand)

21EC2611	SEMICONDUCTOR DEVICES AND CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

Prerequisites for the course
- Fundamentals of Electrical, Electronics and communication

Preamble
- This laboratory is to enhance your knowledge of the basic semiconductor devices with hands-on experience, by measuring their basic characteristics.

S.No	List of Experiments	CO
1	Verifications Of Thevenin & Norton theorem	CO 1
2	Verifications Of Super Position Theorem	CO 1
3	Verifications of Maximum power transfer & reciprocity	CO 1
4	Transient response of RL and RC circuits	CO 2
5	Frequency response of series and parallel resonance circuits	CO 2

6	Characteristics of CE and CB configuration	**CO 3**	
7	Characteristics of JFET and MOSFET	**CO 3**	
8	Characteristics of UJT and SCR	**CO 4**	
9	Characteristics of DIAC and TRIAC	**CO 4**	
10	Simulation of CE,CB and CS Amplifier using PSPICE	**CO 5**	
S.No.	**List of Projects**	**Related Experiment**	**CO**
16.	Analysis of electric circuit.	**1,2,3**	**CO1**
17.	Design of radio receiver	**5**	**CO2**
18.	Voltage regulator using transistor	**6**	**CO 3**
19.	LED Blinker	**6**	**CO 3**
20.	Electronic eye ball	**6**	**CO 3**
21.	Flip-flop	**6**	**CO 3**
22.	Buffer Amplifier	**7**	**CO 3**
23.	Analog switch	**7**	**CO 3**
24.	Burglar Alarm	**9**	**CO4**
25.	Automatic Battery charger	**9**	**CO4**

Suggestive Assessment Methods

Lab Components Assessments (40 Marks)	**End Semester Exams (60 Marks)**
• Lab Experiment • Model Exam	• Lab Exam

Outcomes

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

CO1	**Verify Thevinin & Norton theorem and Super Position Theorems.**
CO2	**Analyze the Response of Resonance circuits.**
CO3	**Understand the Characteristics of BJT and FET.**
CO4	**Analyze the UJT and SCR Characteristics.**
CO5	**Simulate the Transistor and JFET configurations.**

Laboratory Requirements

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
BC 107, BC 148,2N2646,BFW10 - 25 each
1N4007, Zener diodes - 25 each
Resistors, Capacitors, Inductors - sufficient quantities Bread Boards - 15 Nos
CRO (30MHz) – 10 Nos.
Function Generators (3MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos.
PC with ORCAD PSPICE Software-5 Nos

Reference Books

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 6th Edition, 2002.

Web Resources

1. **https://www.youtube.com/watch?v=7JfoDFk61o8**
2. **https://inderjitsingh87.weebly.com/electronic-devices-and-circuits-1.html**
3. **https://www.youtube.com/watch?v=_MHzpX44Rbs**
4. **https://www.youtube.com/watch?v=xgYdLvWcvms**

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1:
1. State Thevenin & Norton theorem
COURSE OUTCOME 2:
  1. A series RLC circuit whose R = 1 kΩ, L = 1 mH and C = 1000 pF is connected across a sinusoidal source of 10 V and Draw the Frequency Response
COURSE OUTCOME 3:
 1. Determine the input and output characteristics of CB Configuration.
COURSE OUTCOME 4:
 1. Determine the VI characteristics of SCR
COURSE OUTCOME 5:
 1. Simulate the CB configuration using PSPICE
COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS	Mapped with POs
1	Verifications Of Thevenin & Norton theorem	1	1(2),2(2),4(2)
2	Verifications Of Super Position Theorem	1	1(2),2(2),4(2)
3	Verifications of Maximum power transfer & reciprocity	1	1(2),2(2),4(2)
4	Transient response of RL and RC circuits	1	1(1),2(1),3(2), 4(2)
5	Frequency response of series and parallel resonance circuits	1	1(1),2(1),3(2), 4(2)
6	Characteristics of CE and CB configuration	1	1(2),2(2),4(2)
7	Characteristics of JFET and MOSFET	1	1(2),2(2),4(2)
8	Characteristics of UJT and SCR	1	1(2),2(2),4(2)
9	Characteristics of DIAC and TRIAC	1	1(2),2(2),4(2)
10	Simulation of CE,CB and CS Amplifier using PSPICE	1	1(1),2(1),3(2), 4(2)

SEMESTER III

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21MA3203	Probability and Numerical Techniques	BS	4	3	1	0	4
2	21EC3501	Object Oriented Programming and Data Structures	ES	3	3	0	0	3
3	21EC3601	Analog Electronics	PC	3	3	0	0	3
4	21EC3602	Signals and Systems	PC	4	3	1	0	4
Theory cum Practical Courses								
1	21EC3603	Digital Logic Design	PC	5	3	0	2	4
Practical Courses								
1	21EC3511	Object Oriented Programming and Data Structures Laboratory	ES	4	0	0	4	2
2	21EC3611	Analog Electronics Laboratory	PC	4	0	0	4	2
3	21PT3901	Aptitude I	EEC	2	1	0	0	1
			Total	29	16	2	10	**23**

21MA3203	**PROBABILITY AND NUMERICAL TECHNIQUES**	L	T	P	C
		3	1	0	4

Preamble:

The course consists of topics in Random variables, Random Processes and Numerical solution of system of equations and differential equations with applications to various engineering problems. This course will cover the following main topics: Probability distributions, Correlation and Linear regression, Classification of random processes, Classification of Markov Process, Newton Raphson method, Gauss Jacobi and Gauss Seidel methods, Fourth order Runge-Kutta method and Milne's method.

Prerequisites for the course
- Basic knowledge about solving system of equations and Probability.
- Differentiation and Integration

Objectives

The Course will enable learners:
1. To apply the concept of random variable and various distribution
2. To equip themselves familiar with basic concept of two dimensional random variable
3. To familiarize the knowledge concept of random process.
4. To develop the proficiency in Numerical techniques and solving linear , non linear equations and algebraic equations arising in engineering applications.
5. Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.

UNIT I	**RANDOM VARIABLES**	**9+3**

Probabilities and its properties - Random variables - Discrete and Continuous random variables – Moments – Moment generating functions – Binomial distributions, Poisson distributions, Uniform distributions and Normal distributions

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Random variables , Moment generating functions, distributions.

UNIT II	**TWO-DIMENSIONAL RANDOM VARIABLES**	**9+3**

Joint distributions – Marginal distributions and Conditional distributions – Covariance – Correlation and Linear regression for two dimensional random variables for Statistical data

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on distributions ,Correlation, regression

UNIT III	RANDOM PROCESSES	9+3

Random processes - Classification of random processes – Stationary process –Wide Sense Stationary process – Ergodic process – Markov process - Poisson process – Random Telegram signal

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on WSS, Markov process, Poisson process

UNIT IV	SOLUTION OF ALGEBRAIC AND SYSTEM OF EQUATIONS	9+3

Solution of algebraic and transcendental equations Newton Raphson method - Solution of linear system of equations - Gauss elimination method - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel.

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Newton Raphson method, Gauss elimination and Gauss Jordan methods.

UNIT V	NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS	9+3

Single step methods : Taylor's series method - Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods: Milne's method for solving first order equations

SUGGESTED EVALUATION METHODS:
- Tutorial Problems on Taylor's series, Euler's method, Fourth order Runge-Kutta method

	Total Periods	45+15 = 60 Periods

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
1. Descriptive Questions	1.Assignment 2. Online Quizzes	1. Descriptive Questions

Outcomes

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

CO1: Apply the fundamental knowledge of moments and distributions (Apply)
CO2: Apply the concept of two dimensional random variables in real life phenomenon (Apply)
CO3: Solve the problems using Random process (Apply)
CO4: Solve linear and non linear system of equations using numerical techniques (Apply)
. CO5: Solve the ordinary differential equations using numerical techniques (Apply)

Text Books

1. Fundamentals of Applied Probability and Random Processes & quot;, Elsevier, Indian Reprint, 2015
2. B. S. Grewal, " Higher Engineering Mathematics", 45rd edition, 2017

Reference Books

1. Hwei Hsu, & quot; Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes & quot;, Tata McGraw Hill Edition, New Delhi, 2016.
2. Taha, H.A., & quot; Operations Research & quot;, 9th Edition, Pearson India Education Services, Delhi, 2016.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 2016.

4. A Textbook of Engineering Mathematics(Dr. A.P.J. Abdul Kalam Technical University, Lucknow) (For . Gautam Bhudh technical Universities ,Lucknow) January 2020
5. Advanced Engineering Mathematics , H. K. DASS, S. CHAND and Company Limited, New Delhi, 22nd revised edition, 2018.

Web Recourses
1. Random variables - https://youtu.be/zujeSyREcQ4
2. Two dimensional random variables - https://youtu.be/_WM8vzYSQhs
1. Random Processes - https://youtu.be/vVEmNUOGKlQ
2. Solving System of equations - https://youtu.be/oD8-Bb5YYmo
3. Numerical solution of ordinary differential equations - https://youtu.be/m2p6hrQGaxQ

CO Vs PO Mapping and CO Vs PSO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	2												
2	3	2												
3	3	2												
4	2	3										2		
5	2	3										2		

ASSESSMENT PATTERN:

BLOOM'S CATEGORY	ASSESSMENT TESTS				END SEMESTER EXAMINATION
	CAT – 1	CAT -2	FAT - 1	FAT - 2	
REMEMBER	10	10	5	5	10
UNDERSTAND	30	30	10	10	30
APPLY	60	60	10	10	60
ANALYZE	0	0	0	0	0
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1 (CO 1) : (Apply)
1) A random variable 'X' has the following probability function

X	0	1	2	3	4	5	6	7	8
p(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

(i) Determine the value of 'a'
(ii) Find $P(X < 3), \ P(X \geq 3), \ P(0 < X < 5)$
(iii) Find the distribution function of X.
2) The weekly wages of 1000 workmen are normally distributed around a mean of Rs. 70 with Standard Deviation of Rs. 5. Estimate the number of workers whose weekly wages will be (i) Between Rs. 69 and 72 (ii) less that Rs. 69 (iii) more than Rs 72.

COURSE OUTCOME 2 (CO 2) : (Apply)
1) If the joint p.d.f of (x,y) is given by p(x,y)=k(2x+3y), x= 0,1,2 &y =1,2,3. Find k and all the marginal and the conditional probability distribution of (x,y) & p(x+y>3)

2) If the joint PDF of X and Y is given by $f(x,y) = \begin{cases} \frac{1}{8}(6-x-y); & 0 < x < 2, 2 < y < 4, \\ 0 & else \end{cases}$

find (a) $P[X < 1 \cap Y < 3]$ and (b) $P[X < 1/Y < 3]$.

COURSE OUTCOME 3 (CO 3) : (Apply)

1)   The process {X(t)} whose probability distribution under certain conditions is given by

$$P(X(t) = n) = \frac{(at)^{n-1}}{(1+at)^{n+1}} \text{ , n =1,2 ,3.....}$$

$$\frac{at}{1+at} \text{ , n =0}$$

   Show that it is not stationary.

   2)   In a village road, buses cross a particular place at a Poisson rate of 4 per hour. If a boy start counting at 9 am. (i) What is the probability that his count is 1 by 9.30 am?   ii) What is the probability that his count is 3 by 11 am?(iii) What is the probability that his count is more than 5 by noon? .

COURSE OUTCOME 4 (CO 4) : (Apply)

1)   Solve $x + y + 54z = 110$,$27x + 6y - z = 85, 6x + 15y + 2z = 72$ by using Gauss Jacobi and Gauss-Seidel iteration method

2)   Find by Newton's method the real positive root of $3x^2 - tanx - 1 = 0$ to three decimal places

COURSE OUTCOME 5 (CO 5) : (Apply)

1. Find y (0.8) given that $\frac{dy}{dx} = y - x^2$, y (0.6) = 1.7393 by using Runge-Kutta method of fourth order. Take h=0.1

   Using Euler's method, solve $\frac{dy}{dx} = xy + y^2$, $y(0)$=1 at x=0.1, 0.2 and 0.3 continue the solution at x=0.4 by Milne's predictor corrector method.

21EC3501	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		3	0	0	3

Prerequisites for the course
- Problem Solving and Logical Thinking using C

Objectives
- To comprehend the fundamentals of object oriented programming, particularly in Java.
- To use object oriented programming to implement data structures.
- To introduce linear, non-linear data structures and their applications.

UNIT I	INTRODUCTION TO JAVA	9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- Characteristics of Java – The Java Environment. Fundamental Programming Structures in Java – constructors, methods -access specifiers -Data Types, Variables, Operators, Control Flow, Looping, Arrays, ArrayList, Strings, Packages.

UNIT II	INHERITANCE, EXCEPTION HANDLING AND MULTI THREADING	9

Inheritance- super and sub classes, member access rules, method overriding, multiple inheritance - interfaces. Exception handling and Multi Threading: Exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions. Multi threading- thread life cycle, creating multiple threads using Thread class.

UNIT III	I/O AND GRAPHICS PROGRAMMING	9

I/O Streams – file streams – byte stream – character stream: creating, processing, opening, and

closing a data file – applet – frames. Working with window AWT classes – AWT control – Layout manager – menus.

UNIT IV	LINEAR DATA STRUCTURES	9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation –– singly linked lists –Polynomial Manipulation – Stack ADT – Queue ADT – Evaluating arithmetic expressions.

UNIT V	NON-LINEAR DATA STRUCTURES	9

Trees – Binary Trees – Binary tree representation and traversals – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Representation of Graphs – Breadth-first search – Depth-first search – Connected components.

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	Formative Assessment Test (10 Marks)	End Semester Exams (60 Marks)
1. DESCRIPTIVE QUESTIONS 2.FORMATIVE MULTIPLE CHOICE QUESTIONS	1.ASSIGNMENT 2. ONLINE QUIZZES 3.PROBLEM-SOLVING ACTIVITIES	1. DESCRIPTIVE QUESTIONS 2. FORMATIVE MULTIPLE CHOICE QUESTIONS

Course Outcomes

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

- Understand the basic concepts of Object Oriented Programming. (Understand)
- Develop Java programs with the concepts such as inheritance, exception handling and mulit-threading. (Apply)
- Develop interactive Java programs using applet and frame. (Apply)
- Implement abstract data types for linear data structures using java (Apply)
- Implement non-linear data structures using java (Apply)
- Understand the applications of data structures (Apply)

Text Books

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.
2. E. Balagurusamy, 2004, Programming with JAVA, 2nd Edition,Tata McGraw-Hill Publishing Co.Ltd.
3. Data Structures and Algorithms in Java, 2nd edition, Robert Lefore, SAMS publishing, 2003
4. Data Structures and Algorithms in Java, 2nd edition, M.T.Goodrich and R.Tamassia, John Wiley and Sons, Inc.

Reference Books

1. Data Structures and Java Collections Frame Work, W.J.Collins, McGraw Hill.
2. Data Structures Using Java, Yedidyah Langsam, Moshe Augenstein, Aaron M. Tenenbaum, Pearson Education.
3. Data Structures and Software Development in an Object Oriented Domain, Java Edition, Tremblay, Pearson Education.
4. Data Structures with Java, J.R.Hubbard and A.Huray, Pearson Education/PHI.

Web Resources

1. https://www.mygreatlearning.com/blog/data-structures-using-java/

CO Vs PO Mapping and CO Vs PSO Mapping

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

3	3	2	2	1							1	2	2
4	3	2	2	1							1	2	
5	3	2	2	1							1	2	

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	10	5	5	10
UNDERSTAND	40	20	10	10	20
APPLY	40	50	5	5	50
ANALYZE		20	5	5	20
EVALUATE					
CREATE					

COURSE LEVEL ASSESSMENT QUESTIONS

Course Outcome 1 (CO1): Understand the basic concepts of Object Oriented Programming
1. List the features of OOP. (Remember)
2. Illustrate classes and objects with an example program. (Understand)
3. Explain how methods can be defined. (Understand)

Course Outcome 2 (CO2): Develop Java programs with the concepts such as inheritance, exception handling and mulit-threading.
1. Define inheritance. (Remember)
2. Explain how exceptions can be handled? (Understand)
3. Write a java program for Banking Transactions using Multithreading. (Apply)

Course Outcome 3 (CO3): Develop interactive Java programs using applet and frame
1. Write an Applet code to draw a Smiley. (Apply)
2. Implement a scientific calculator using Swing in java.(Apply)
3. Implement Library Management System using Swing in java. (Apply)

Course Outcome 4 (CO4): Implement abstract data types for linear data structures using java.
1. Define ADT. (Remember)
2. List the Linear Data Structures. (Remember)
3. Implement Stack using java. (Create)

Course Outcome 5 (CO5): Implement non-linear data structures using java
1. Write a java program to implement the Tree traversals. (Apply)
2. Implement BFS and DFS in java. (Apply)

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED
	UNIT I - INTRODUCTION TO JAVA	
1	Object Oriented Programming - Abstraction – objects and classes - Encapsulation	1
2	Inheritance -Polymorphism	1

3	Characteristics of Java – The Java Environment	1
4	Fundamental Programming Structures in Java	1
5	Constructors, Methods	1
6	access specifiers -Data Types, Variables, Operators	1
7	Control Flow, Looping	1
8	Arrays, ArrayList	1
9	Strings, Packages	1
UNIT II- INHERITANCE, EXCEPTION HANDLING AND MULTI THREADING		
10	Inheritance- super and sub classes, member access rules, method overriding	1
11	multiple inheritance - interfaces	1
12	Exception handling and Multi Threading: Exception hierarchy	1
13	throwing and catching exceptions	1
14	built-in exceptions	
15	creating own exceptions	1
16	Multi threading	1
17	thread life cycle	1
18	creating multiple threads using Thread class	1
UNIT-III - I/O AND GRAPHICS PROGRAMMING		
19	I/O Streams	1
20	file streams	1
21	byte stream – character stream	1
22	creating, processing, opening, and closing a data file	1
23	applet	1
24	frames	1

25	Working with window AWT classes	1
26	AWT control	1
27	Layout manager – menus	1

UNIT-IV - LINEAR DATA STRUCTURES		
28	Abstract Data Types (ADTs)	1
29	List ADT	1
30	array-based implementation	1
31	linked list implementation	1
32	singly linked lists	1
33	Polynomial Manipulation	1
34	Stack ADT	1
35	Queue ADT	1
36	Evaluating arithmetic expressions	1

UNIT-V - NON-LINEAR DATA STRUCTURES		
37	Trees	1
38	Binary Trees	1
39	Binary tree representation and traversals	1
40	Application of trees: Set representation and Union-Find operations	1
41	Graph and its representations	1
42	Graph Traversals	1
43	Representation of Graphs	1
44	Breadth-first search – Depth-first search	1
45	Connected components	1

21EC3601	ANALOG ELECTRONICS	L	T	P	C
		3	0	0	3

Prerequisites for the course
- Semiconductor Devices and Circuits

Preamble

The course "21EC3601: Analog Electronics" is offered in the third semester. The purpose of this course is to understand the small signal analysis and frequency response of BJT & FET circuits and apply the knowledge to give solutions. Moreover, the concepts of power amplifiers, the methods of feedback in amplifiers and the multivibrator circuits are covered in this course.

UNIT I	BJT AMPLIFIERS	9

DC load line - Operating point - Various biasing methods for BJT amplifier - AC load line – Stability – Compensation methods – Small signal analysis of CE amplifier - AC Coupling - Frequency response - Multistage amplifier - Darlington Amplifier - Differential Amplifier

UNIT II	FET AMPLIFIERS	9

Various biasing methods for FET amplifiers – small signal analysis of CS, CD, CG amplifier circuits - Frequency Response of CS amplifier – Miller Effect – Current Mirrors – Cascaded amplifier – Cascoded amplifier

UNIT III	POWER AMPLIFIERS	9

Class A, Class B, Class AB, Class C, Class D Amplifiers - Amplifiers using Complementary Symmetry configuration - Non Linear Distortion - Power Transistor and Heat sink - Tuned Amplifiers - Switched Mode Power Supply (SMPS)

UNIT IV	FEEDBACK AMPLIFIERS AND OSCILLATORS	9

Feedback Concept- Analysis of Negative feedback amplifiers: Voltage Series, Current Series, Current Shunt, Voltage Shunt - Conditions for Oscillation - RC & LC Oscillator –phase shift Oscillator - Wien Bridge Oscillator - Hartley Oscillator- Colpitts Oscillator -Tuned Collector Oscillator - Crystal Oscillators

UNIT V	PULSE CIRCUITS	9

Attenuators – RC integrator and differentiator circuits – diode clampers and clippers – multivibrators - Schmitt Trigger

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	Formative Assessment Test (10 Marks)	End Semester Exams (60 Marks)
Descriptive Answers- CAT-1, CAT-2	• Quiz • MCQ • Open Book Test • Seminar	Descriptive Answers

Outcomes

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

CO 1	Understand the working of different types of amplifier, oscillator and multivibrator circuits.
CO 2	Design BJT and FET amplifier and oscillator circuits
CO 3	Design and analyze the power amplifier.
CO 4	Analyze transistorized amplifier and oscillator circuits
CO 5	Review the applications of different types of amplifier, oscillator, attenuators and multivibrator circuits

Text Books

1. Donald .A. Neamen, Electronic Circuit Analysis and Design –3rd Edition, Tata Mc Graw Hill, 2010.
2. Adel S. Sedra, Kenneth C.Smith, Tony Chan Carusone and Vincent Gaudet "Microelectronic Circuits", Oxford University Press, 8th Edition, 2020.

Reference Books

1. Behzad Razavi, "Fundamentals of Microelectronics", 1st edition, Wiley publication, 2008.

2. Millman & Halkias, "Integrated Electronics", 48th reprint, Tata McGraw Hill, 2008.
3. David A., "Bell Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010.

Web Resources

1. http://ncert.nic.in/textbook/pdf/leph206.pdf
2. https://www.elprocus.com/semiconductor-devices-types-and-applications/
3. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee32/
4. https://www.youtube.com/watch?v=J6QS_aCT2No
5. https://www.youtube.com/watch?v=88lo7MgCpNo

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	15	10	10	10	15
UNDETSTAND	20	20	10	10	20
APPLY	30	30	10	10	30
ANALYZE	20	25	10	10	20
EVALUATE	15	15	10	10	15
CREATE	0	0	0	0	0
	100	100	50	50	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. Give the condition of thermal stability
2. In a self bias circuit calculate V_{CE} and I_C and stability factor where $\alpha = 0.985$ for the silicon transistor, Given V_{CC}=16V, R_1=56KΩ, R_2=20KΩ, R_c = 3KΩ, R_e =2KΩ

COURSE OUTCOME 2:
1. State Miller's theorem
2. Elucidate the high frequency operation of common source amplifier with its equivalent circuit

COURSE OUTCOME 3:
1. A tuned amplifier is designed to receive AM broadcast of speech signal at 650 kHz. What is the needed Q for amplifier?
2. Compare the different classes of large signal amplifiers with neat sketch and table

COURSE OUTCOME 4:
1. State the Barkhausen criteria for sustained oscillation. What will happen to the oscillation if the magnitude of the loop gain is greater than unity?
2. Design LC circuit for Hartley and Colpitts oscillators to oscillate at 600KHz

COURSE OUTCOME 5:
1. Distinguish the multivibrators and oscillators
2. Review on RC integrator and differentiator circuits

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED	Mapped with POs
	UNIT I - BJT AMPLIFIERS		
1	DC load line, Operating point	1	PO1, PO2
2	Various biasing methods for BJT amplifier	1	PO1, PO2, PO3
3	AC load line - Stability	1	PO1, PO2
4	Compensation methods - Small signal analysis of CE amplifier	2	PO1, PO2, PO3, CO4
5	AC Coupling - Frequency response	1	PO1, PO2, PO3, CO4
6	Multistage amplifier - Darlington Amplifier - Differential Amplifier	3	PO1, PO2
	UNIT 2 - FET AMPLIFIERS		
7	Various biasing methods for FET amplifiers	1	PO1, PO2, PO3
8	Small signal analysis of CS, CD, CG amplifier circuits	3	PO1, PO2, PO3
9	Frequency Response of CS amplifier– Miller Effect	2	PO1, PO2, PO3, PO4
10	Current Mirrors	1	PO1, PO2, PO3
11	Cascaded amplifier – Cascoded amplifier	2	PO1, PO2, PO3
	UNIT 3- POWER AMPLIFIERS		
12	Class A, Class B, Class AB, Class C, Class D Amplifiers	3	PO1, PO2, PO3

13	Amplifiers using Complementary Symmetry configuration	1	PO1, PO2, PO3
14	Non Linear Distortion - Power Transistor and Heat sink	2	PO1, PO2, PO3
16	Tuned Amplifiers	2	PO1, PO2, PO3, PO4
17	Switched Mode Power Supply (SMPS)	1	PO1, PO2
UNIT 4- FEEDBACK AMPLIFIERS AND OSCILLATORS			
18	Feedback Concept	1	PO1
19	Analysis of feedback amplifiers: Voltage Series, Current Series, Current Shunt, Voltage Shunt	2	PO1, PO2, PO3, PO4
20	Conditions for Oscillation	1	PO1, PO2, PO3
21	RC & LC Oscillators using BJT	1	PO1, PO2, PO3
22	Phase shift Oscillator - Wien Bridge Oscillator - Hartley Oscillator	2	PO1, PO2, PO3, PO4
23	Colpitts Oscillator - Tuned Collector Oscillator - Crystal Oscillators	2	PO1, PO2, PO3
UNIT 5- PULSE CIRCUITS			
24	Attenuators	2	PO1, PO2
25	RC integrator and differentiator circuits	2	PO1, PO2, PO3, PO4
26	Diode clampers and clippers	2	PO1, PO2, PO3
27	Multivibrators	2	PO1, PO2, PO3, PO4
28	Schmitt Trigger	1	PO1, PO2, PO3

21EC3602	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

Prerequisites for the course
- Fundamentals of Partial Differential Equation and Application of Fourier Series

Preamble

- Signals and Systems arise in a wide variety of fields, and the ideas and techniques associated with these concepts play an important role in areas of science and technology as communications, aeronautics and astronautics, acoustics, seismology, biomedical engineering and speech processing. The signal can be either analog or converted digital signal. Processing of both the signal type requires some mathematics. This course provides the basic knowledge on the required mathematics for further processing of signals.

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9+3

Continuous time signals (CT signals) – discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential –Transformation of the independent variable – Representation of signals – Classification of CT and DT signals – CT systems and DT systems – Linear Time invariant (LTI) Systems and properties – MATLAB exercises for generation of basic elementary signals

UNIT II	FREQUENCY DOMAIN REPRESENTATION OF CONTINUOUS TIME SIGNALS	9+3

Fourier Series representation of CT periodic signals – Convergence of Fourier Series – Properties – Differential equation – Fourier Transform Representation of signal – Convergence of Fourier Transforms – Properties – Analysis of LTI Systems using Fourier Transform – Frequency response – MATLAB exercises for Fourier Transforms

UNIT III	LAPLACE DOMAIN REPRESENTATION OF CONTINUOUS TIME SIGNALS	9+3

Laplace Transform – Region of Convergence for Laplace Transform – Inverse Laplace Transform – Properties – Convolution integral – Properties – Impulse response – Impulse response of interconnected systems – Analysis and characterization of LTI system using Laplace transform

UNIT IV	FREQUENCY DOMAIN REPRESENTATION IN DISCRETE TIME SIGNALS	9+3

Sampling- Representation of sequences - Discrete Time Fourier Transform (DTFT) - Properties of DTFT - Impulse response of a system with DTFT - Frequency response of a system with DTFT - Solution of linear constant coefficient difference equations – MATLAB exercises for sampling process

UNIT V	ANALYSIS AND CHARACTERISATION OF DISCRETE TIME LTI SYSTEM	9+3

Z transform – Region of convergence of finite duration sequences - Properties of Z transform– Relation between DTFT and Z transform - Inverse Z transform - Analysis and characterization of DT system using Z-transform - Evaluation of Impulse response & Step response -Convolution Sum

	Total Periods	45+15

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers- CAT-1, CAT-2	• MCQ • Open Book Test • Assignment • Problem-Solving Activities	• Descriptive Answers

Outcomes

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

CO 1	Clarify signal properties like periodicity, even or odd, energy or power and system properties such as causality, linearity and time-invariance
CO 2	Determine the frequency response of periodic and aperiodic continuous time signals using Fourier transform

CO 3	Interpret the response of an LTI interconnected System of a given continuous time input signal interms of Laplace
CO 4	Convert a continuous time signal into discrete time signal and reconstruct the continuous time signal.
CO 5	Analyze and characterize LTI system using z-Transforms

Text Books

1. Alan V Oppenheim, Ronald W. Schafer Signals & Systems, 2nd ed., Pearson Education, 2015
2. P.Ramakrishna Rao, Shankar Prakriya, Signals & Systems, 2nd ed., McGraw Hill Education, 2015

Reference Books

1. Simon Haykin, Barry Van Veen, Signals and Systems, 2nd ed., John Wiley & Sons Inc., 2007
2. Lathi B.P, Linear Systems & Signals, 2nd ed., Oxford Press, 2009
3. John G. Proakis, Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, 4th ed., Pearson Education, 2007.

Web Resources

1. https://www.youtube.com/watch?v=2D66kbRiVko
2. https://www.youtube.com/watch?v=spUNpyF58BY
3. https://www.youtube.com/watch?v=n2y7n6jw5d0
4. https://www.youtube.com/watch?v=Ww_8hPQcCHs
5. https://www.youtube.com/watch?v=hewTwm5P0Gg

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	3	3		2	1									3
2	3	3		2	1									3
3	2	3		3										3
4	3	3		3	1									3
5	3	3		3										3

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	0	20	0	0
UNDETSTAND	20	20	20	40	40
APPLY	40	60	40	40	40
ANALYZE	20	20	20	20	20
EVALUATE	0	0	0	0	0
CREATE	0	0	0	0	0
	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. Show that $\delta(n) = u(n) - u(n-1)$ **(Understand)**
2. For the each of the following systems, determine whether or not the system is Linear and Time invariant.   **(Apply)**
   (i) $y(n) = x(n) \cos(0.2\pi n)$
   (ii) $y(n) = A\, x(n) + B$, where A and B are constants.

COURSE OUTCOME 2:
1. A periodic signal x(t) is given by $x(t) = 1 + 2\cos(300\pi t + \pi/4) + \sin(500\pi t)$ **(Understand)**
   a. What is the period of x (t)?
   b. Predict the Fourier series coefficient of x(t) for $-6 \le k \le 6$
2. Calculate the FT of the following and sketch the magnitude and phase spectrum **(Apply)**
   a. $x(t) = \delta(t)$
   b. $x(t) = u(t)$
   c. $x(t) = e^{-3t}\, u(t)$

COURSE OUTCOME 3:
1. Resolve the Laplace transform X(s) and sketch the pole-zero plot with the ROC for the following signals x(t): **(Apply)**
   a. $x(t) = e^{-3t}\, u(t) + e^{2t}\, u(-t)$
   b. $x(t) = e^{2t}\, u(t) + e^{-4t}\, u(-t)$
2. Let $x(t) = u(t-1) - u(t-5)$ and $h(t) = e^{-3t}\, u(t)$ **(Analyze)**
   a. Compute $y(t) = x(t)*h(t)$
   b. Compute $g(t) = (dx(t)/dt) * h(t)$
   c. How g(t) related to y(t).

COURSE OUTCOME 4: (Apply)
1. Consider the analog signal $x_a(t) = 3\cos(2000\pi t) + 5\sin(6000\pi t) + 10\cos(12000\pi t)$
   a. What is the Nyquist rate for this signal?
   b. Assume now that we sample this sample using a sampling rate Fs= 5000 samples/sec. What is the discrete time signal obtained after sampling? **(Apply)**
2. Consider the interconnection of LTI systems as shown in figure **(Apply)**
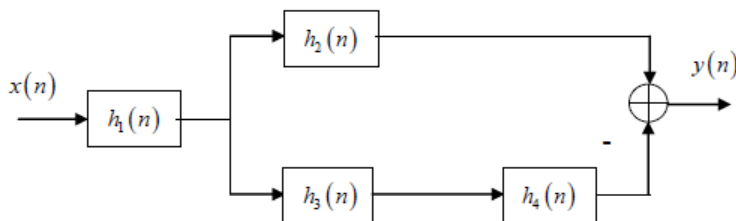
Express the overall impulse response in terms of $h_1(n)$, $h_2(n)$, $h_3(n)$ and $h_4(n)$.

COURSE OUTCOME 5: (Analyze)
1. Infer the system function for the given equation. Also calculate the step response. $y(n) - 0.7y(n-1) + 0.1y(n-2) = 2x(n) - x(n-2)$ **(Analyze)**
2. Convolve the following two sequences x(n) and h(n) to get y(n). $x(n) = \{1,1,1\}$ and $h(n) = \{2,2\}$. Also give the illustration **(Analyze)**

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED	Mapped with POs
	UNIT-1 - CLASSIFICATION OF SIGNALS AND SYSTEMS		

1	Continuous time signals (CT signals)	1	1
2	Discrete time signals (DT signals)	1	1
3	Step, Ramp, Pulse, Impulse, Exponential	1	1,2
4	Transformation of the independent variable	1	1
5	Operations of signals	2	1,2
6	Classification of CT and DT signals	2	1,2,4
7	CT systems and DT systems	2	1,2,4
8	Linear Time invariant (LTI) Systems and properties	1	1,2
9	MATLAB exercises for generation of basic elementary signals	1	5
UNIT-2 - FREQUENCY DOMAIN REPRESENTATION OF CONTINUOUS TIME SIGNALS			
10	Fourier Series representation of CT periodic signals, Convergence of Fourier Series	2	1,2
11	Properties	1	1
12	Differential equation	1	1,2
13	Fourier Transform Representation of signal	1	2
14	Convergence of Fourier Transforms	1	1,2
15	Properties	1	1
16	Analysis of LTI Systems using Fourier Transform	2	2,4
17	Frequency response	2	2,4
18	MATLAB exercises for Fourier Transforms	1	5
UNIT-3 - LAPLACE DOMAIN REPRESENTATION OF CONTINUOUS TIME SIGNALS			
19	Laplace Transform	2	1,2
20	Region of Convergence for Laplace Transform	1	2
21	Inverse Laplace Transform	2	4
22	Properties	1	1
23	Convolution integral – Properties	2	4
24	Impulse response	1	2,4

| 25 | Impulse response of interconnected systems | 1 | 2,4 |
| 26 | Analysis and characterization of LTI system using Laplace transform | 2 | 2,4 |

UNIT-4 - FREQUENCY DOMAIN REPRESENTATION IN DISCRETE TIME SIGNALS

26	Sampling	1	1
27	Representation of sequences	1	1
28	Discrete Time Fourier Transform (DTFT)	2	2
29	Properties of DTFT	1	1
30	Impulse response of a system with DTFT	2	2,4
31	Frequency response of a system with DTFT	2	2,4
32	Solution of linear constant coefficient difference equations	2	2,4
33	MATLAB exercises for sampling process	1	5

UNIT-5 - ANALYSIS AND CHARACTERISATION OF DISCRETE TIME LTI SYSTEM

34	Z transform	1	1
35	Region of convergence of finite duration sequences	1	2
36	Properties of Z transform	1	1
37	Relation between DTFT and Z transform	1	1
38	Inverse Z transform	2	2,4
39	Analysis and characterization of DT system using Z-transform	1	2,4
40	Evaluation of Impulse response	2	4
41	Step response	2	2,4
42	Convolution Sum	1	4

		L	T	P	C
21EC3603	**DIGITAL LOGIC DESIGN**	**3**	**0**	**2**	**4**

Prerequisites for the course
- Semiconductor Devices and Circuits

Preamble

All of the foundational ideas in digital design will be covered in the course on Digital Logic Design. Beginning with Boolean algebra and the reduction of logic gates using K map and Tabulation techniques. Sequential and combinational circuit design strategies will be used after that. The

topics of semiconductor memories and Hardware Description Language (HDL) will be discussed. It is a study of digital circuit optimization and design analysis of semiconductor memory circuits as well as combinatorial and sequential circuits.

UNIT I	BOOLEAN ALGEBRA AND LOGIC GATES REDUCTION TECHNIQUES	8

Basic theorems and properties of Boolean algebra, Boolean functions-Sum of Product (SOP) and Product of Sum (POS) expressions. Positive and negative logic system. Algebraic simplification of Boolean expression NAND-NOR circuit implementations AND-OR -Invert implementations. Karnaugh map(K-map) simplification Techniques for SOP and POS functions up to five variable Don't care condition for simplification of Boolean function. Tabulation Methods.

UNIT II	COMBINATIONAL LOGIC CIRCUITS	8

Combinational Circuits- Half adder, full adder, parallel binary adder, half Subtractor , full subtractor, parallel binary subtractor, Carry look ahead Adder, BCD Adder,code converters, Decoder and Encoder, Multiplexers and Demultiplexers, Magnitude Comparator, Parity Generators and Checkers. BCD to Seven segment decoder.

UNIT III	SEQUENTIAL LOGIC CIRCUITS	8

Master/Slave Flip Flop – operation and Flip flop excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design -Moore/Mealy models, state minimization, state assignment, circuit implementation –Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV	ASYNCHRONOUS SEQUENTIAL CIRCUITS & HARDWARE DESCRIPTION LANGUAGE	8

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits. Introduction to Verilog- Structure of Verilog module, Gate level Modelling for basic GATES.

UNIT V	BASIC MEMORY STRUCTURE	8

Memory Devices- ROM -PROM – EPROM – EEPROM –EAPROM, RAM –Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL).

	Total Periods	40

LABORATORY

S.NO	NAME OF THE EXPERIMENTS	HOURS	CO
1.	Create/Test 2 input basic logic gates using NOR/NAND gate	1 hours	1
2.	Construct a circuit employing logic gates to convert 4 bit binary to gray code.	2 hours	2
3.	Implement and test a half-adder circuit	2 hours	2
4.	Implement and test a Full subtractor circuit	2 hours	2
5.	Design/Test the 3X8 Decoder circuit.	2 hours	2
6.	Design/Test the 8X1Multiplexer circuit.	1 hours	2
7.	Build/Test BCD to Seven segment LED Display circuit.	2 hours	2
8.	Build/Test the functionality of the SR Flip-Flop.	2 hours	4
9.	Build/Test the working of the Shift Register.	2 hours	4
10.	Build/Test the working of the 4 bit Ripple Counter.	2 hours	4
11.	Build/Test the working of 4 bit UP - DOWN Counter.	2 hours	4
	Total Periods	20	

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers-CAT-1, CAT-2	• Lab Experiment • Lab Model exam	• Descriptive Answers

Outcomes	
Upon completion of the course, the students will be able to:	
CO1	Optimize logic circuits using minimization techniques.
CO2	Design combinational digital circuits using logic gates.
CO3	Do the analysis and design for synchronous sequential circuits.
CO4	Analyse and design Asynchronous sequential circuits and Gate level modelling.
CO5	Design of semiconductor memories using optimized logic structure.

Text Books

1. M. Morris R. Mano and Michael D. Ciletti, Digital Design With an Introduction to the Verilog HDL, 2014, 6th Edition, Prentice Hall of India, India
2. S.Salivahanan and S.Arivazhagan "Digital circuits and Design, 5th Edition, Oxford University Press.

Reference Books

1. Charles H. Roth, Jr., Fundamentals of Logic Design, 2014, 7th Edition Reprint, Brooks/Cole, Pacific Grove, US.
2. Jain, R P , Morden Digital Electronics, TMH Education , New Delhi, 3rd Edition or latest.
3. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc,2011.
4. Fundamentals of HDL- Cyril P R Pearson/Sanguin 2010.
5. "Verilog HDL: A Guide to Digital Design and Synthesis", 2nd Edition, Samir Palnitkar, Prentice Hall Professional, (2003).

Web Recourses

1. http://www.infocobuild.com/education/audio-video-courses/electronics/DigitalCircuits-IIT-Kharagpur/lecture-08.html
2. http://www.infocobuild.com/education/audio-video-courses/electronics/DigitalCircuits-IIT-Kharagpur/lecture-11.html
3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
4. https://www.youtube.com/watch?v=FWE0-FOoE4s
5. https://nptel.ac.in/courses/117/106/117106086/

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	Lab Experiment	Lab Model Exam	END SEM EXAM
REMEMBER	20		20		10

UNDERSTAND	30		30		20
APPLY	40	40	40	40	30
ANALYZE		40		40	20
EVALUATE					
CREATE	10	20	10	20	20
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1:
1. What is your answer for the following question
   Sum of product expression for the function $f(W,X,Y,Z)=\sum(0,1,3,5,14)+d(8,15)$ is –

2. The Boolean function $f(A,B,C,D)=\sum(3,7,11,13,14,15)$ simplifies to -------
COURSE OUTCOME 2:

1. Consider the 1:4 demultiplexer circuit shown below. What would be the output bits for input condition S0=1, S1=1 and Din=1?
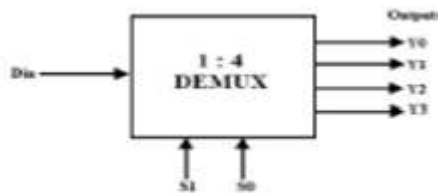
2. Identify the output (Y) of the folowing circuit
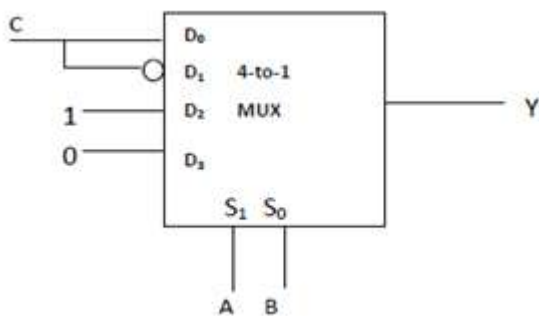
COURSE OUTCOME 3:
1. Using T Flip-flop design binary counter which counts in the sequence 000, 001, 010, 011, 100, 101, 110, 111, 000
2. Derive the transition table, state table and state diagram for moor sequential circuit shown in below figure.
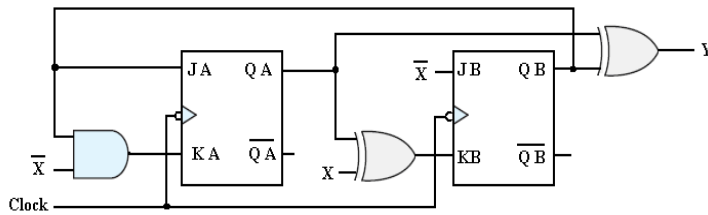
COURSE OUTCOME 4:

1. Which stable state depend on an order in race ?
2. What does the construct "#5" indicate in simulation?

COURSE OUTCOME 5:

1. Implement the switching function F(A,B,C,D)=$\sum_m$(1,3,5,7,8,9,14,15) by a static hazard free two level AND-OR gate network..
2. Implement binary to Gray code converter using PROM devices

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with Pos
UNIT I – BOOLEAN ALGEBRA AND LOGIC GATES REDUCTION TECHNIQUES			
1	Basic theorems and properties of Boolean algebra, Boolean functions	1	1,2,3 (0.4,0.4,0.2)
2	Sum of Product (SOP) and Product of Sum (POS) expressions. Positive and negative logic system.	1	1,2,3 (.4,.4,.2)
3	Algebraic simplification of Boolean expression NAND-NOR circuit implementations AND-OR –Invert implementations.	1	1,2,3 (.2,.4,0.4)
4	Karnaugh map(K-map) simplification Techniques for SOP and POS functions up to five variable	2	1,2,3,4 (0.4,.4,.8,.4)
5	Don't care condition for simplification of Boolean function.	1	1,2,3,4 (0.2,.2,.4,.2)
6	Tabulation Methods.	2	1,2,3,4 (0.4,.4,.8,.4)
UNIT-II COMBINATIONAL LOGIC CIRCUITS			
7	Half adder, full adder, Parallel binary adder	1	1,2 (.5,.5)
8	half Subtractor , full subtractor, Parallel binary subtractor	1	1,2 (.5,.5)

9	Carry look ahead Adder, BCD Adder	1	1,2,3 (.4,.4,.2)
10	code converters	2	1,2,3 (.2,.6,.1.2)
11	Decoder and Encoder	1	1,2,3 (.4,.4,.2)
12	Multiplexers and Demultiplexers, Magnitude Comparator	1	1,2,3 (.4,.4,.2)
13	Parity Generators and Checkers. BCD to Seven segment decoder	1	1,2,3 (.4,.4,.2)
UNIT-III SEQUENTIAL LOGIC CIRCUITS			
14	Master/Slave Flip Flop, Operation and Flip flop excitation tables, Triggering of FF	1	1,2,3
15	Analysis and design of clocked sequential circuits	2	1,2,3,4 (.4,.4,.6,.6)
16	Design -Moore/Mealy models, state minimization, state assignment, Circuit Implementation	2	1,2,3,4 (.3,.3,.7,.7)
17	Design of Counters- Ripple Counters, Ring Counters	2	1,2,3,4 (.3,.3,.7,.7)
18	Shift registers, Universal Shift Register	1	1,2,3,4 (.2,.2,.3,.3)
UNIT-IV ASYNCHRONOUS SEQUENTIAL CIRCUITS & HARDWARE DESCRIPTION LANGUAGE			
19	Stable and Unstable states, output specifications	1	1,2,3 (.2,.4,.4)
20	cycles and races, state reduction, race free assignments	1	1,2,3,4 (.2,.3,.3,.2)
21	Hazards, Essential Hazards, Pulse mode sequential circuits	2	1,2,3,4 (.3,.3,.7,.7)
22	Design of Hazard free circuits.	1	1,2,3,4 (.2,.2,.3,.3)
23	Introduction to Verilog- Structure of Verilog module,	1	1,2 (0.5,0.5) (.4,.4,.2)
24	Gate level modelling for basic logic gates	2	1,2

			(0.5,0.5)
	UNIT-V BASIC MEMORY STRUCTURE		
25	ROM -PROM - EPROM – EEPROM	1	1,2,3 (.2,.4,.4)
26	EAPROM, RAM	1	1,2,3 (.2,.4,.4)
27	Static and dynamic RAM	1	1,2,3 (.2,.4,.4)
28	Programmable Logic Devices	1	1,2,3 (.4,.6,1)
29	Programmable Logic Array (PLA)	2	1,2,3 (.4,.6,1)
30	Programmable Array Logic (PAL)	2	1,2,3 (.4,.6,1)

21EC3511	**OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Prerequisites for the course:
- C/C++ Programming

Objectives:
- To Learn Java programming language.
- Be exposed to the different data structures
- Be familiar with applications using different data structures
- To implement linear and non-linear data structures.
- To implement graph traversal algorithms

S.No	List of Experiments	CO
1	Basic Programs for Java Concepts	CO1
2	Program to define inheritance and show method overriding.	CO1
3	Program to demonstrate Exception Handling.	CO1
4	Program to demonstrate Multithreading.	CO1
5	Array implementation of List Abstract Data Type (ADT)	CO2
6	Linked list implementation of List ADT	CO2
7	Stack ADT – Array and linked list implementations	CO2
8	Evaluation of a postfix expression using Stack.	CO5
9	Queue ADT – Array and linked list implementations.	CO2
10	Implementation of Binary Tree Traversals.	CO3
11	Implementation of Graph Traversals.	CO4
		Total Periods : 60

Suggestive Assessment Methods

Lab Components Assessments (50 Marks)	End Semester Exams (50 Marks)
• Lab Experiment	• Practical Exam

- Viva
- Model Exam

Outcomes:

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

CO 1 Apply good programming design methods for program development (APPLY)

CO 2 Design and implement Java programs for manipulating Linear Data structures (APPLY)

CO 3 Design and implement Java programs for manipulating Non-Linear Data structures. (APPLY)

CO 4 Design and implement graph traversals.(APPLY)

CO 5 Identify, implement and use the appropriate data structures for a given problem. (ANALYSE)

CO 6 Design and implement java programs with proper Exception Handling. (APPLY)

Laboratory Requirements:

- JDK8.
- Operating system: Windows

Reference Books

1. Herbert Schildt, "Java The complete reference", 8th Edition, McGraw Hill Education, 2011.

2. E. Balagurusamy, 2004, Programming with JAVA, 2nd Edition,Tata McGraw-Hill Publishing Co.Ltd.

3. Data Structures and Algorithms in Java, 2nd edition, Robert Lefore, SAMS publishing, 2003

4. Data Structures and Algorithms in Java, 2nd edition, M.T.Goodrich and R.Tamassia, John Wiley and Sons, Inc.

Web Resources

1. https://www.mygreatlearning.com/blog/data-structures-using-java/

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3		3							1	2	1	2
2	3	2	3		3							1	2	2	
3	3	2	3		3							1		2	
4	3	2	3		3							1		2	
5	3	2	3		3							1		2	
6	3	2	3		3							1	2	1	

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	Model Exam	END SEM EXAM
REMEMBER		
UNDERSTAND		
APPLY	100	100
ANALYZE		
EVALUATE		
CREATE		

COURSE LEVEL ASSESSMENT QUESTIONS:

Course Outcome 1 (CO1): Apply good programming design methods for program development
1. Write a program for code reusability. (Apply)
Course Outcome 2 (CO2): Design and implement Java programs for manipulating Linear Data structures
1. Implement Stack ADT with its operations in java. (APPLY)
Course Outcome 3 (CO3): Design and implement Java programs for manipulating Non-Linear Data structures.
1. Implement Binary tree traversals in java. (APPLY)
Course Outcome 4 (CO4): Design and implement graph traversals
1. Implement BFS and DFS in java. (Apply)
Course Outcome 5 (CO5): Identify, implement and use the appropriate data structures for a given problem
1. Implement Polynomial Manipulations using appropriate data structure in java. (CREATE)
Course Outcome 6 (CO6): Design and implement java programs with proper Exception Handling. (APPLY)
1. Write a java program with proper Exception Handling.
COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED
1	Basic Programs for Java Concepts	6
2	Program to define inheritance and show method overriding.	6
3	Program to demonstrate Exception Handling.	3
4	Program to demonstrate Multithreading.	6
5	Array implementation of List Abstract Data Type (ADT)	3
6	Linked list implementation of List ADT	6
7	Stack ADT – Array and linked list implementations	6
8	Evaluation of a postfix expression using Stack.	6
9	Queue ADT – Array and linked list implementations.	6
10	Implementation of Binary Tree Traversals.	6
11	Implementation of Graph Traversals.	6

21EC3611	ANALOG ELECTRONICS LABORATORY	L	T	P	C
		0	0	4	2

Prerequisites for the course
- The Prerequisites for the Analog Electronics Laboratory course is we must know the basics of the Semiconductor Devices and Circuits subjects.

Preamble

The preamble of this laboratory course enables students to get practical experience in design, assembly, testing and evaluation of Rectifiers and Voltage Regulators, BJT characteristics and Amplifiers, JFET Characteristics and Amplifiers, MOSFET Characteristics and Amplifiers, Power Amplifiers, RC-Phase shift, Hartley, Colpitts and Crystal Oscillators. The students Acquire a basic knowledge in solid state electronics including diodes, MOSFET, BJT, and operational amplifier. Develop the ability to analyze and design analog electronic circuits using discrete components. Observe the amplitude and frequency responses of common amplification circuits. Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis.

S.No	List of Experiments	CO
1	Frequency Response of CE amplifier	CO 1
2	Darlington Amplifier	CO 1
3	Differential Amplifiers- Transfer characteristic, CMRR Measurement	CO 2
4	RC Phase shift oscillator and Wien Bridge Oscillator	CO 2
5	Hartley Oscillator and Colpitts Oscillator	CO 3
6	Single Tuned Amplifier	CO 3
7	Series and Shunt feedback amplifiers-Frequency response, Input and output impedance	CO 4
8	RC integrator and differentiator	CO 4
9	Design of multivibrator using PSpice	CO 5
10	Analysis of Frequency Response of BJT using PSpice	CO 5
11	Class A and Class B Power Amplifiers using PSpice	CO 6

S.No.	List of Projects	Related Experiment	CO
1.	Design Common Emitter Audio Amplifier	1,2,3	CO 1, CO2
2.	Design and construction of a guitar amplifier	1,2,3	CO 1, CO2
3.	Design of Darlington Pair and a Relay	1,2,3	CO 1, CO2
4.	Design of Light and Dark Amplifier	1,2,3	CO 1, CO2
5.	Power regulators and Audio amplifier of Darlington	1,2,3	CO 1, CO2
6.	Simple Mobile Phone Detector Circuit using Op-Amp.	1,2,3	CO 1, CO2
7.	Over Heat Detector with Auto Cut-Off System using Op-Amp	1,2,3	CO 1, CO2
8.	Triangular Wave Generator Circuit with Op Amp IC 741	1,2,3	CO 1, CO2
9.	Design Phase Shift Oscillator with Stripboard Version	4,5	CO 2, CO3
10.	Design LED Lamp Stabilised Wien Bridge Oscillator	4,5	CO 2, CO3
11.	Analysis of Voltage and Current Measurements	4,5	CO 2, CO3
12.	Design Radio receivers is the Hartley Oscillator	4,5	CO 2,

			CO3
13.	Operational Amplifier Tester Circuit	3,6,7	CO 2, CO4
14.	Phone Ring Amplifier Circuit	3,6,7	CO 2, CO4
15.	Laser Sound Transmission Circuit	3,6,7	CO 2, CO4
16.	Design a feedback amplifiers with Frequency response	3,6,7	CO 2, CO4
17.	Single Pulse RC Integrator Charging and discharging Circuit's	8,9	CO5
18.	Design of Astable Multivibrator Circuit using PSpice	8,9	CO5
19.	Online Frequency Response Analysis of Electric Machinery	10,11	CO5, CO6
20.	Build a class D power amplifier	10,11	CO5, CO6
21.	Simple Boost Converter Circuit Using 555 Timer IC	10,11	CO5, CO6

Suggestive Assessment Methods

Lab Components Assessments (50 Marks)	End Semester Exams (50 Marks)
50	50

Outcomes

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

CO1	Apply the concepts of amplifiers in the design of Public Addressing System
CO2	Generate Sinusoidal wave forms of given specifications.
CO3	Design stable system using feedback concepts
CO4	Analyse various types of multivibrators
CO5	Design tuned amplifiers, integrator and differentiator.

Laboratory Requirements

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
BC 107, BC 547, CL100- 25 each
Resistors, Capacitors, Inductors - sufficient quantities Bread Boards - 15 Nos
CRO (30MHz) – 10 Nos.
Function Generators (3MHz) – 10 Nos.
Dual Regulated Power Supplies (0 – 30V) – 10 Nos.
PC with ORCAD PSPICE Software-5 Nos

Reference Books

1. Laboratory Manual, Department of ECE, FXEC.
2. David A Bell, "Laboratory Manual for Electronic Devices and Circuits", 4th edition, D.A. Bell, 2001.
3. L. K. Maheshwari, M. M. S. Anand, "Laboratory Experiments and PSPICE Simulations in Analog Electronics", PHI, 2006

Web Resources

1. http://ncert.nic.in/textbook/pdf/leph206.pdf
2. https://www.elprocus.com/semiconductor-devices-types-and-applications/
3. https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee32/
4. https://www.youtube.com/watch?v=J6QS_aCT2No

5. https://learnabout-electronics.org/Oscillators/osc34.php

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1:
1. Frequency Response of CE amplifier
2. Darlington Amplifier

COURSE OUTCOME 2:
1. RC Phase shift oscillator and Wien Bridge Oscillator

COURSE OUTCOME 3:
1. Hartley Oscillator and Colpitts Oscillator

COURSE OUTCOME 4:
1. Single Tuned Amplifier

COURSE OUTCOME 5:
1. RC integrator and differentiator

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS REQUIRED
1	Frequency Response of CE amplifier	1
2	Darlington Amplifier	1
3	Differential Amplifiers- Transfer characteristic, CMRR Measurement	1
4	RC Phase shift oscillator and Wien Bridge Oscillator	1
5	Hartley Oscillator and Colpitts Oscillator	1
6	Single Tuned Amplifier	1
7	Series and Shunt feedback amplifiers-Frequency response, Input and output impedance	1
8	RC integrator and differentiator	1
9	Design of multivibrator using PSpice	1
10	Analysis of Frequency Response of BJT using PSpice	1

11	Class A and Class B Power Amplifiers using PSpice	1

21PT3901	APTITUDE I	L	T	P	C
		1	0	0	1

Prerequisites for the course
- Basic Maths

Objectives
1. Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
2. Students will be able to reason, model, and draw conclusions or make decisions with mathematical, statistical, and quantitative information.

UNIT I	MODULE I	3

Number system, Number series, HCF and LCM of Numbers, Factors and Decimals.

UNIT II	MODULE II	3

Square roots and cube roots, Indices and surds, Simplification and approximation, Problems on ages and numbers.

UNIT III	MODULE III	3

Percentage, Profit, loss and discount, Average, Ratio and Proportion.

UNIT IV	MODULE IV	3

Partnership and share, Alligation and mixtures, Time, work and wages.

UNIT V	MODULE V	3

Pipes and cisterns, simple interest, Compound interest, Growth and depreciation.

	Total Periods	**15**

Suggestive Assessment Methods

Continuous Assessment Test (30 Marks)	Formative Assessment Test (10 Marks)	End Semester Exams (60 Marks)
1. DESCRIPTIVE QUESTIONS 2. FORMATIVE MULTIPLE CHOICE QUESTIONS	1.ASSIGNMENT 2. ONLINE QUIZZES 3.PROBLEM-SOLVING ACTIVITIES	1. DESCRIPTIVE QUESTIONS 2. FORMATIVE MULTIPLE CHOICE QUESTIONS

Outcomes

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

CO1: Solve real-life problems requiring interpretation and comparison of complex numeric summaries which extend beyond simple measures of center.

CO2: Solve real-life problems requiring interpretation and comparison of various representations of ratios

CO3: Distinguish between proportional and nonproportional situations and, when appropriate, apply proportional reasoning.

CO4: Develop an answer to an open-ended question requiring analysis and synthesis of multiple calculations, data summaries, and/or models.

CO5: justify and communicate their conclusions in ways appropriate to the audience.

Text Books

1. Quantitative Aptitude for Competitive Examinations, 7th Edition (Paperback, Abhijit Guha)

Reference Books

1. https://myupsc.com/wp-content/uploads/2020/11/Quantitative-Aptitude-for-

Competitive-Examinations-by-Dinesh-Khattar-z-lib.org .pdf
2. Quantitative Aptitude for Competitive Examinations - Quantitative Aptitude by rs agrawal with 0 Disc. (English, Paperback, Aggarwal R. S.) Revised, 2021

Web Recourses
1. https://pdf.bankexamstoday.com/raman_files/Quant%20Formula.pdf
2. https://ugcportal.com/raman-files/QT-TRICKS.pdf
3. https://www.javatpoint.com/aptitude/quantitative#speed-and-distance
4. https://www.indiabix.com/aptitude/questions-and-answers/

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2		2		1	1	3			2	2		3	1	
2				2		3		1	2		1	1		2	
3	2	2	2	2			2		3	3			2	1	
4				2		1	2	2				1	2	1	
5	2		3		2		2		2		2			2	1

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	10	5	5	10
UNDERSTAND	40	20	10	10	20
APPLY	40	50	5	5	50
ANALYZE		20	5	5	20
EVALUATE					
CREATE					

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED
	UNIT I – MODULE I	
1	Number system, Number series	1
2	HCF and LCM of Numbers	1
3	Factors and Decimals.	1
	UNIT II – MODULE II	
4	Square roots and cube roots	1
5	Indices and surds, Simplification and approximation	1

6	Simplification and approximation, Problems on ages and numbers.	1
UNIT-III MODULE III		
7	Percentage	1
8	Profit, loss and discount	1
9	Average, Ratio and Proportion.	1
UNIT-IV MODULE IV		
10	Partnership and share	1
11	Alligation and mixtures	1
12	Time, work and wages.	1
UNIT-V MODULE V		
13	Pipes and cisterns	1
14	Simple interest, Compound interest	1
15	Compound interest, Growth and depreciation.	1

SEMESTER IV

S.No	Course Code	Course Name	Category	Contact Periods	L	T	P	C
Theory Courses								
1	21EC4601	Analog and Digital Communication	PC	3	3	0	0	3
2	21EC4602	Applied Electromagnetics	PC	3	3	0	0	3
3	21EC4604	Principles of Computer Networks	PC	3	3	0	0	3
4	21EC4605	Control Systems	PC	3	3	0	0	3
Mandatory Course								
1	21GE2M02	Environmental and Sustainable Engineering	MC	2	2	0	0	0
Theory cum Practical Courses								
1	21EC4603	Linear Integrated Circuits	PC	5	3	0	2	4
Practical Courses								
1	21EC4611	Analog and Digital Communication Laboratory	PC	4	0	0	4	2
2	21PT3902	Verbal Ability	EEC	2	1	0	0	1
			Total	25	18	0	6	**19**

21EC4601	ANALOG AND DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

Prerequisites for the course

- Fundamentals of Electrical, Electronics and communication.
- Semiconductor Devices and Circuits
- Partial Differential Equation and Application of Fourier Series

Preamble

- This course aims at designing Analog and Digital communication systems that are used for the transmission of information from source to destination. A detailed quantitative framework for analog and digital transmission techniques is addressed.

UNIT I	ANALOG COMMUNICATION	9

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of DSBSC, SSBSC and VSB- Theory of Frequency and Phase Modulation - PM–FM Conversion, FM–PM Conversion, Single tone, Narrow Band and Wideband FM – Transmission Bandwidth

UNIT II	DIGITAL MODULATION AND TRANSMISSION	9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Binary Phase Shift Keying (BPSK) – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency–ISI – Pulse shaping – Duo binary encoding – Eye pattern, equalizers.

UNIT III	PULSE MODULATION	9

Sampling Theorem – Natural sampling – Flattop sampling- Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM), DM - ADM, Time Division Multiplexing, Frequency Division Multiplexing.

UNIT IV	INFORMATION THEORY AND CODING	9

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, Syndrome calculation, cyclic codes,

Convolution Coding, Viterbi decoding.		
UNIT V	**SPREAD SPECTRUM AND MULTIPLE ACCESS**	**9**

PN sequences – properties – m-sequence – DSSS – Processing gain, Jamming – FHSS - Synchronisation and tracking – Multiple Access – FDMA, TDMA, CDMA.

	Total Periods	**45**

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers- CAT-1, CAT-2	• Quiz • MCQ • Open Book Test	• Descriptive Answers

Outcomes

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

CO1	Design and implement various analog modulation techniques.
CO2	Design and implement various digital modulation techniques.
CO3	Design and implement various pulse modulation techniques.
CO4	Examine the principles behind information theory and coding.
CO5	Design and implement various spread spectrum techniques and multi-user radio communication.

Text Books

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 4/e, TMH 2017.
2. S. Haykin "Digital Communications" John Wiley 2013.

Reference Books

1. B.P. Lathi, Zhi Ding and Hari Mohan Gupta."Modern Digital And Analog Communication Systems: Fourth Edition", 4rd edition, South Asia edition, Oxford University Press, 2017.
2. H P Hsu, Schaum Outline Series "Analog and Digital Communications" TMH 2006.
3. B.Sklar, "Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

Web Resources

1. **https://onlinecourses.nptel.ac.in/noc19_ee46/preview** (Analog Communication)
2. **https://onlinecourses.nptel.ac.in/noc21_ee30/preview** (Digital Communication)
3. **https://www.youtube.com/watch?v=TJNKoRPn-G8** (CDMA & Spread Spectrum)

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	3	2	0							1	1	2
2	3	2	3	2	0							1	1	2
3	2	2	3	2	0							1		2
4	3	2	2	3	0							1		2
5	3	2	3	3	0			2				1		2

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	10	10	10	10	10

UNDERSTAND	10	10	10	10	10
APPLY	20	20	30	30	20
ANALYZE	20	20	10	10	20
EVALUATE	40	40	20	20	40
CREATE					
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. Sketch the one cycle of AM wave and calculate the modulation index of it in terms of Vmax and Vmin voltages (Design)
2. Design an non coherent receiver FM. (Design)

COURSE OUTCOME 2:
1. Design an QPSK modulator and demodulator with neat diagram and also compare BPSK. (Design)
2. Design a 16 QAM transmitter with the truth table. (Design)

COURSE OUTCOME 3:
1. Design a PCM modulator and demodulator with neat diagram. (Design)
2. Design a ADM modulator and demodulator with neat diagram. (Design)

COURSE OUTCOME 4:
1. Consider five messages S0, S1, S2, S3, S4 given by the probabilities 1/2, 1/4, 1/8, 1/16, 1/16. Make use of Shannon –Fano algorithm and Huffman coding algorithm to develop an efficient code. Compare the coding efficiency. (Apply)
2. Develop an viterbi decoding procedure used for decoding convolution Codes. (Apply)

COURSE OUTCOME 5:
1. Design a DSSS modulator and demodulator with neat diagram. (Design)
2. Design a FHSS modulator and demodulator with neat diagram. (Design)

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED	Mapped with POs
	UNIT I - ANALOG COMMUNICATION		
1.	Introduction to Communication Systems - Modulation – Types - Need for Modulation	1	1,2,3,4,12
2.	Theory of Amplitude Modulation - Evolution and Description of DSBSC	1	1,2,3,4
3.	SSBSC	1	1,2,3,4
4.	VSB	1	1,2,3,4

5.	Theory of Frequency and Phase Modulation	1	1,12
6.	PM–FM Conversion, FM–PM Conversion,	1	1,12
7.	Single tone	1	1,2,3,4
8.	Narrow Band and Wideband FM	1	1,2,3,4
9.	Transmission Bandwidth	1	1,2,4
UNIT 2- DIGITAL MODULATION AND TRANSMISSION			
10.	Amplitude Shift Keying (ASK)	1	1,2,3,4,12
11.	Frequency Shift Keying (FSK)	1	1,2,3,4
12.	Binary Phase Shift Keying (BPSK)	1	1,2,3,4
13.	QPSK	1	1,2,3,4
14.	Quadrature Amplitude Modulation (QAM) – 8 QAM –	1	1,2,3,4
15.	16 QAM – Bandwidth Efficiency	1	1,2,3,4
16.	ISI – Pulse shaping	1	1,2,3,4
17.	Duo binary encoding – Eye pattern,	1	1,2,3,4
18.	Equalizers.	1	1,2,3,12
UNIT 3- PULSE MODULATION			
19.	Sampling Theorem – Natural sampling	1	1,12
20.	Flattop sampling	1	1,12
21.	Pulse Amplitude Modulation (PAM)	1	1,2,3,4
22.	Pulse Time Modulation (PTM)	1	1,2,3,4
23.	Pulse code Modulation (PCM)	1	1,2,3,4
24.	DM	1	1,12
25.	ADM	1	1,12
26.	Time Division Multiplexing,	1	1,12
27.	Frequency Division Multiplexing.	1	1,12
UNIT 4- INFORMATION THEORY AND CODING			
28.	Entropy, Source encoding theorem	1	1,12

29.	Shannon fano coding	1	1,2,3,4
30.	Huffman coding	1	1,2,3,4
31.	Mutual information, channel capacity	1	1,12
32.	Error Control Coding	1	1,2,3,4
33.	linear block codes	1	1,2,3,4,12
34.	Syndrome calculation, cyclic codes	1	1,2,3,4,12
35.	Convolution Coding	1	1,2,3,4,12
36.	Viterbi decoding.	1	1,2,3,4,12
UNIT 5- SPREAD SPECTRUM AND MULTIPLE ACCESS			
37.	PN sequences	1	1,12
38.	properties – m-sequence	1	1,12
39.	Processing gain, Jamming DSSS	1	1,2,3,4,8,12
40.	Processing gain, Jamming – FHSS	1	1,2,3,4,8,12
41.	Types of FHSS	1	1,12
42.	Synchronisation and tracking	1	1,12
43.	Multiple Access – FDMA	1	1,2,3,4,8,12
44.	TDMA	1	1,2,3,4,8,12
45.	CDMA	1	1,2,3,4,8,12

21EC4602	APPLIED ELECTROMAGNETICS	L	T	P	C
		3	0	0	3

Prerequisites for the course
- Fundamentals of Electrical, Electronics and communication

Preamble

The field of applied electromagnetics has roots going back to giants of electrical engineering such as Maxwell, Faraday, Hertz, Marconi, and Tesla. In recent years it has expanded beyond antennas and radio wave propagation to include emerging areas such as micro-electromechanical systems, metamaterials, nanomagnetics, biological applications of electromagnetic fields, information technologies, and other novel devices and structures. There is a strong need for students with skills in these areas in the industries of telecommunications, defense, microwave instruments, medical devices, and other areas. These industries are growing rapidly, driven in particular by the continuing expansion of wireless communications and related technologies. This program will prepare students for a broad range of career opportunities in research and technology development in the expanding field of applied electromagnetics.

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
Introduction- Electric Field-Electric Field Intensity -Electric Field due to discrete charges - Electric field due to continuous charge distribution Electric Field due to charges distributed uniformly on a finite line - Electric Field on the axis of a uniformly charged circular disc and uniformly charged sheet. Electric Scalar Potential – Relationship between potential and electric field - Potential due to electrical dipole - Electric Flux Density Electrostatic energy and energy density-Gauss Law and Applications		
UNIT III	MAGNETOSTATICS	9
Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques		
UNIT IV	TIME-VARYING FIELDS AND MAXWELL's EQUATIONS	9
Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.		
UNIT V	EMI/EMC CONCEPTS	9
EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility; Case Histories; Radiation Hazards to humans, ESD.		
	Total Periods	**45**

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers- CAT-1, CAT-2	• Quiz • MCQ	• Descriptive Answers

Outcomes

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

CO1	Solve problems based on the understanding of electric and magnetic fields in free space and in materials.
CO2	Outline the behaviour of static Electric fields in free space.
CO3	Outline the behaviour of static magnetic fields in free space.
CO4	Apply the concepts of static electric and magnetic fields in materials and Interpret guided waves in both electric and magnetic modes.
CO5	Identify the various types and mechanisms of Electromagnetic Interference.

Text Books

1. Field And Wave Electromagnetics by David K. Cheng, January 2014 (Unit I – IV)
2. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.(Unit V)

Reference Books

1. William H Hayt, John A Buck, Engineering Electromagnetics, McGraw-Hill Higher Education,8th edition, 2011.
2. Bhag Guru and Huseyin Hiziroglu, Electromagnetic Field Theory Fundamentals, Cambridge

University Press, 2nd edition, 2004
3. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2013
4. B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011 Edition, 2008.

Web Resources
1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009/
2. https://www.youtube.com/watch?v=NK-BxowMIfg
3. https://www.youtube.com/watch?v=qjsZTBZd1Ms
4. https://www.youtube.com/watch?v=X4NNGHkP-Fg
5. https://www.youtube.com/watch?v=yxbshDyGPng

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	30	30	20	20	20
UNDERSTAND	30	30	20	20	30
APPLY	30	30	40	40	30
ANALYZE	10	10	20	20	20
EVALUATE					
CREATE					
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1:
1. Given the two points A (x=2, y=3, z=-1) and B (r=4, θ=25, φ=120 °). Solve the spherical coordinates of A and Cartesian coordinates of B.
2. Explain the Stokes theorem with their applications.

COURSE OUTCOME 2:
1. Determine the electric flux density at (1,0,2) if there is a point charge 10Mc at(1,0,0) and a line charge of 50 mC/m along y axis.
2. Obtain a formula for the electric field intensity on the axis of a circular disc of radius b and carries uniform charge density ρs.

COURSE OUTCOME 3:

1. From the Biot Savart's law, write the expression for magnetic field intensityat a point P and distance R from the infinitely long straight current carrying conductor.
2. A circular loop located on $x^2 + y^2 = 9$, z = 0 carries a direct current of 10 A along aφ. Calculate H at (0,0,4) and (0,0,-4).

COURSE OUTCOME 4:
1. Derive the wave equation starting from Maxwell's equation for free space .
2. Derive the Maxwell's equation both in integral form and differential form of Ampere's law, Faraday's law and Gauss law.

COURSE OUTCOME 5:
1. Explain the different sources of EMI in detail. Give example.
2. Give an account of radiation hazards.

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with POs
UNIT I - INTRODUCTION			
1	Electromagnetic model - Units and constants	1	1
2	Review of vector algebra	1	2
3	Rectangular, cylindrical and spherical coordinate systems	2	1,3
4	Line, surface and volume integrals	2	2,3
5	Gradient of a scalar field, Divergence of a vector field	1	2
6	Divergence theorem, Curl of a vector field, Stoke's theorem	1	2
7	Null identities, Helmholtz's theorem	1	1
UNIT 2- ELECTROSTATICS			
8	Introduction- Electric Field-Electric Field Intensity	1	1
9	Electric Field due to discrete charges - Electric field due to continuous charge distribution	1	3,4
10	Electric Field due to charges distributed uniformly on a finite line	1	3
11	Electric Field on the axis of a uniformly charged circular disc	1	3
12	Electric Field on the axis of a uniformly charged sheet	1	3
13	Electric Scalar Potential – Relationship between potential and electric field	1	2
14	Potential due to electrical dipole	1	1
15	Electric Flux Density Electrostatic energy and energy	1	1

	density		
16	Gauss Law and Applications	1	3,4
UNIT 3- MAGNETOSTATICS			
17	Lorentz force equation , Law of no magnetic monopoles	1	1
18	Ampere's law, Vector magnetic potential,	2	3,4
19	Biot-Savart law and applications	2	3,4
20	Magnetic field intensity and idea of relative permeability	1	1
21	Magnetic circuits, Behaviour of magnetic materials	1	1
22	Boundary conditions	1	2
23	Inductance and inductors, Magnetic energy, Magnetic forces and torques	1	1
UNIT 4- TIME-VARYING FIELDS AND MAXWELL's EQUATIONS			
24	Faraday's law	1	1
25	Displacement current and Maxwell-Ampere law	1	1
26	Maxwell's equations	2	3
27	Potential functions	1	1
28	Electromagnetic boundary conditions	1	2
29	Wave equations and solutions	2	4
30	Time-harmonic fields	1	1
UNIT 5- EMI/EMC CONCEPTS			
31	EMI-EMC definitions	1	1
32	Sources and Victims of EMI	2	2
33	Conducted and Radiated EMI Emission and Susceptibility	3	2
34	Case Histories; Radiation Hazards to humans	2	6,7
35	ESD	1	6

		L	T	P	C
21EC4604	**PRINCIPLES OF COMPUTER NETWORKS**	**3**	**0**	**0**	**3**

Prerequisites for the course

• Analog and Digital Communication	

Preamble

- The objectives of this course are to provide a comprehensive and in-depth understanding of the concepts of computer networks, extend the students" knowledge in error detection and error correction, network protocols, the upper layers of the OSI model, security and provide knowledge in knowing emerging trends in networking technologies

UNIT I	FUNDAMENTALS AND PHYSICAL LAYER	9

Overview, data communications, networks ,types, Protocol Layering, TCP/IP protocol – layers , OSI Model - layers, multiplexing, topologies, transmission media, packet switching- error detection and correction-ATM

UNIT II	DATA LINK LAYER AND INTERNETWORKING	9

HDLC –-controlled access-Ethernet (802.3) - Wireless LANs – IEEE 802.11 – Bluetooth – WiMax– IPV4 Address – IPv6 Addressing- Network layer protocols (IP, ICMP, Mobile IP)

UNIT III	ROUTING	9

Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Intradomain protocols – DVMRP, MOSPF,PIM – Interdomain routing Protocols – IGMP.

UNIT IV	TRANSPORT AND APPLICATION LAYER	9

Introduction to Transport layer –Protocols- User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) –Services – Features – TCP Connection – Flow, Error and Congestion Control - Congestion avoidance (DEC bit, RED) - World Wide Web and HTTP – DNS- Electronic Mail (SMTP, POP3, IMAP, MIME) - Data-Flow Characteristics- Flow Control To Improve Qos.

UNIT V	NETWORK SECURITY AND COMPUTING	9

Cryptography and Network Security – Introduction - Confidentiality - Other Aspects Of Security - Firewalls-
Network slicing-Mobile edge cloud-content distribution-Software Defined Networks

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive type questions • Formative multiple choice questions	• Quiz • MCQ	• Descriptive type questions • Formative multiple choice questions

Outcomes

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

CO1	clearly understand the building blocks of networks and its physical layer.
CO2	Trace the flow of information from one node to another node in the network and understand the various MAC Protocols and internetworking
CO3	Illustrate the various routing concepts, mechanisms and protocols
CO4	Describe the services and techniques of Transport Layer and application layer
CO5	Illustrate various security techniques and security devices used in communication networks

Text Books

1. Behrouz A. Forouzan, "Data communication and Networking with TCP/IP protocol suite", sixth Edition, Tata McGraw Hill, 2021
2. Frank H.P. Fitzek , Fabrizio Granelli , Patrick Seeling "Computing in Communication Networks -From Theory to Practice", Academic Press, 2020.

Reference Books

1. William Stallings,"Data and Computer Communications",Tenth Edition,Pearson Education,2014
2. Oliver.C.lbe"Fundamentals of Data Communication Networks",Wiley,2018
3. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2016

Web Resources
1. https://onlinecourses.nptel.ac.in/noc21_cs18/preview
2. https://beginnersbook.com/category/computer-network/

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	40	20	10	10	20
UNDERSTAND	50	30	10	10	30
APPLY	10	20	10	10	20
ANALYZE	0	15	10	10	15
EVALUATE	0	15	10	10	15
CREATE	0	0	0	0	0
Total	100	100	50	50	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. Illustrate TCP/IP suite with examples
2. Analyze error detection and correction methods

COURSE OUTCOME 2:
1. Distinguish IPv4 and IPv6
2. Discuss the IEEE 802.11 standards.

COURSE OUTCOME 3:
1. Find the shortest path using distance vector routing for a given network
2. Compare and contrast various multicast routing protocols.

COURSE OUTCOME 4:
1. Distinguish TCP and UDP
2. Elaborate on protocols related to Electronic mail.

COURSE OUTCOME 5:

1. Discuss on various types of firewalls
2. Give a detailed study on computing trends in communication networks

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS REQUIRED
UNIT I - FUNDAMENTALS AND PHYSICAL LAYER		
1	Overview, data communications, networks ,types, Protocol Layering,	1
2	TCP/IP protocol – layers	1
3	OSI Model - layers	2
4	multiplexing, topologies, transmission media	1
5	packet switching	1
6	error detection and correction	2
7	ATM	1
UNIT 2- DATA LINK LAYER AND INTERNETWORKING		
8	HDLC	1
9	controlled access-Ethernet (802.3)	1
10	Wireless LANs – IEEE 802.11	1
11	Bluetooth	1
12	WiMax	1
13	IPV4 Address	1
14	IPv6 Addressing	1
15	Network layer protocols -IP	1
16	Network layer protocols- ICMP	1
17	Network layer protocols- Mobile IP	1
UNIT 3- ROUTING		
18	Unicast Routing – Algorithms	2
19	Unicast Routing -Protocols	2

20	Multicast Routing and its basics	1
21	Intradomain protocols – DVMRP, MOSPF,PIM	3
22	Interdomain routing Protocols – IGMP.	1
UNIT 4- TRANSPORT AND APPLICATION LAYER		
23	Introduction to Transport layer Protocols- User Datagram Protocols (UDP)	1
24	Transmission Control Protocols (TCP) –Services – Features – TCP Connection	1
25	Flow, Error and Congestion Control	1
26	Congestion avoidance (DEC bit, RED)	2
27	World Wide Web and HTTP	1
28	DNS	1
29	Electronic Mail (SMTP, POP3, IMAP, MIME)	1
30	Data-Flow Characteristics- Flow Control To Improve Qos	1
UNIT 5- NETWORK SECURITY AND COMPUTING		
31	Cryptography and Network Security – Introduction - Confidentiality - Other Aspects Of Security	2
32	Firewalls-	1
33	Network slicing	1
34	Mobile edge cloud	1
35	content distribution	1
36	Software Defined Networks	2

21EC4605	CONTROL SYSTEMS	L	T	P	C
		3	0	0	3

Prerequisites for the course

- Transforms and Partial Differential Equations
- Mathematics that teaches complex variables and Laplace transform.

Preamble

To introduce the components and their representation of control systems and to learn various methods for analysing the time response, frequency response and stability of the systems and also learn the various approach for the state variable analysis.

UNIT I	SYSTEM MODELLING AND REPRESENTATION	9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Systems-Transfer Function Models-Electrical Analogy. Block diagram Models-Signal flow graphs models.

UNIT II	TIME RESPONSE ANALYSIS	9

Standard test signals – Time response specifications-Time response of First and Second order system for step input and ramp input - poles & zeros-effect of additional pole & additional zero-Steady state error constants-Basics of P, PI, PD, and PID Controller.

UNIT III	FREQUENCY RESPONSE ANALYSIS & DESIGN	9

Frequency domain specifications- Frequency response of standard second order system- Bode Plot - Polar Plot- Design Procedure of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.

UNIT IV	STABILITY ANALYSIS	9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion- Root locus concept & guidelines for sketching root locus-Nyquist stability criterion.

UNIT V	STATE VARIABLE REPRESENTATION	9

Introduction to state space analysis- State models of linear systems - Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability- State transition matrix, State space representation of discrete time system

	Total Periods	45

Suggestive Assessment Methods

Continuous Assessment Test (20 Marks)	Formative Assessment Test (20 Marks)	End Semester Exams (60 Marks)
• Descriptive Answers- CAT-1, CAT-2	• Quiz • MCQ • Open Book Test • Seminar • Debate	• Descriptive Answers

Outcomes

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

CO1	Understand the various control system components and their representations
CO2	Analyze the various time domain parameters
CO3	Analyze the Bode plot and polar plot.
CO4	Apply the concepts of various system stability criterions.
CO5	Design various transfer functions of digital control system using state variable models

Text Books

1. M.Gopal, "Control System – Principles and Design" , Tata McGraw Hill, 4th Edition, 2012
2. Nagrath.J and Gopal.M," Control System Engineering", New Age International Publishers, 2017

Reference Books

1. Ogata K, "Modern Control Engineering", Prentice Hall of India, New Delhi, 2013.
2. Gopal.M, "Digital Control and State Variable Methods", McGraw- Hill, 4th Edition, 2012.
3. Benjamin Kuo, ─Automatic Control Systems‖, Prentice Hall of India, New Delhi, 2010.

Web Resources

1. https://onlinecourses.nptel.ac.in/noc22_de09/preview
2. https://www.youtube.com/watch?v=f4WGCQXqfnw
3. https://www.youtube.com/watch?v=VSDLCdKfzMo
4. https://www.youtube.com/watch?v=zY-pRRlFxbI

5. https://www.youtube.com/watch?v=sUDoTw_LIbk

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	20	10	10	20
UNDERSTAND	30	30	10	10	30
APPLY	20	20	10	10	20
ANALYZE	15	15	10	10	15
EVALUATE	15	15	10	10	15
CREATE	0	0	0	0	0
Total	100	100	50	50	100

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1 (Understand)

1. Write the differential equation governing the mechanical rotational system. And obtain its transfer function $\frac{\theta_1(s)}{T(s)}$
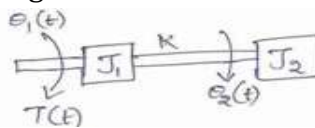
2. Draw the signal flow graph for the following system and find its transfer function using Mason's gain formula

$$x_2 = a_{12}x_1 + a_{22}x_2 + a_{32}x_3$$
$$x_3 = a_{23}x_2 + a_{43}x_4$$
$$x_4 = a_{24}x_2 + a_{34}x_3 + a_{44}x_4$$
$$x_5 = a_{25}x_2 + a_{45}x_4$$

Course Outcome 2 – Analyse

1. The system with the open loop transfer function 1/s (1+s) is:

2. Given a unity feedback system with G (s) =K/ s (s+4). What is the value of K for a damping ratio of 0.5?

Course Outcome 3 – Analyse

1. The polar plot of a transfer function passes through the critical point (-1, 0). Gain margin is

2. The forward path transfer function of a unity feedback system is given by G(s) = 100/ (s²+10s+100). Sketch the Bode plot for the above transfer function.

Course Outcome 4 - Apply

1. First column elements of the Routh's tabulation are 3, 5, -3/4, ½, 2. It means that there are:

2. The characteristic equation of a control system is given by $s^6+2s^5+8s^4+12s^3+20s^2+16s+16=0$. The number of the roots of the equation which lie on the imaginary axis of s-plane

Course Outcome 5 - Design

1. According to the property of state transition method, e0 is equal to _____

2. For a system with the transfer function $H(s) = 3(s-2)/s^3+4s^2-2s+1$, the matrix A in the state space form is equal to

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with POs
UNIT I - SYSTEM MODELLING AND REPRESENTATION			
1	Control System: Terminology and Basic Structure	1	1
2	Feed forward and Feedback control theory	1	1(.5),6(.5)
3	Electrical and Mechanical Systems	2	1(1),2(1),
4	Transfer Function Models	1	1(.5),2(.5),
5	Electrical Analogy	1	1(.5),2(.5),
6	Block diagram Models	1	1(.2),2(.4), 4(.4),
7	Signal flow graphs models	2	1(.4),2(.8), 4(.8)
UNIT 2-TIME RESPONSE ANALYSIS			
8	Standard test signals	1	1
9	Time response specifications	2	1(.4),2(.8), 3(.8),
10	Time response of First and Second order system for step input and ramp input	1	1(.2),2(.4), 3(.4),
11	Poles & zeros-effect of additional pole & additional zero	2	1(.4),2(.8), 3(.8)
12	Steady state error constants	1	1(.5),2(.5)
13	Basics of P,PI,PD,PID Controller.	2	1(.4),2(.8), 6(.8)
UNIT 3- FREQUENCY RESPONSE ANALYSIS & DESIGN			
14	Frequency domain specifications	1	1(.5),2(.5)

15	Frequency response of standard second order system	1	1(.5),2(.5)
16	Bode Plot	2	1(.4),2(.8), 3(.8)
17	Polar Plot	1	1(.2),2(.4), 3(.4)
18	Design Procedure of compensators using Bode plots	1	1(.2),2(.4), 3(.4)
19	Cascade lead compensation	1	1(.2),2(.4), 3(.4)
20	Cascade lag compensation	1	1(.2),2(.4), 3(.4)
21	Cascade lag-lead compensation.	1	1(.2),2(.4), 3(.4)
UNIT 4- STABILITY ANALYSIS			
20	Concept of stability	1	1(.5),2(.5)
21	Bounded - Input Bounded - Output	2	1(1),2(1)
22	Stability, Routh stability criterion	2	1(.4),2(.8), 4(.8)
23	Root locus concept & guidelines for sketching root locus	2	2(.4),3(.8), 4(.8)
24	Nyquist stability criterion	2	2(.4),3(.8), 6(.8)
UNIT 5- STATE VARIABLE REPRESENTATION			
25	Introduction to state space analysis	1	1
26	State models of linear systems	1	1(.5),2(.5)
27	Conversion of state variable models to transfer functions-	2	1(.4),2(.8), 3(.8)
28	Conversion of transfer functions to state variable models	1	1(.2),2(.4), 3(.4)
29	Solution of state equations	1	2(.5),3(.5)
30	Concepts of Controllability and Observability	1	2(.5),3(.5)
31	State transition matrix	1	2(.5),3(.5)

32	State space representation of discrete time system	1	2(.5),3(.5)

21GE2M02	**ENVIRONMENTAL AND SUSTAINABLE ENGINEERING**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**0**

Preamble

To inculcate knowledge on the environment and all sorts of biotic and abiotic components related to its ecosystem, climate changes and challenges faced due to global warming and the importance of renewable sources of energy. Inspire students to find ways in contributing personally and professionally thereby rectifying environmental and social problems.

Prerequisites for the course

. Basic theoretical concepts of biological science in higher secondary level.
. Basic theoretical concepts of Engineering Chemistry.

Objectives

- To make the students conversant with the interdisciplinary and holistic nature of the environment.
- To make the students understand the impacts of environmental degradation and to minimise vulnerability to future disasters.
- To enrich the students with the significance of natural resources and environment on the quality of life.
- To have an increased awareness among students to create a quest on issues in areas of sustainability.
- To have a thorough understanding of the concepts of sustainable habitat.

UNIT I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY**	**7**

Environment: Definition, Scope and Importance of environment studies. Ecosystem: Structure and function of an ecosystem - Producers - Consumers – Decomposers- Types – Characteristic features: Forest ecosystem - Desert ecosystem - Pond ecosystem-Ocean ecosystem.
Biodiversity - Value of biodiversity - Hot-spots of biodiversity- Threats to biodiversity - Endangered and Endemic species - 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 & DISASTER MANAGEMENT**	**6**

Pollution: Definition - Causes - Effects - Control measures of air pollution - Water pollution: (Sewage water treatment by activated sludge and trickling filter process) - Marine pollution - Noise pollution.
Disaster management: Causes - Effects - Control measures of Floods - Earthquake - Cyclone.
Field study of local polluted sites – Urban / Rural / Industrial / Agricultural.

UNIT III	**NATURAL RESOURCES**	**6**

Forest resources: Use - Overexploitation - Deforestation - case studies. Water resources: Use - Overutilization of surface and groundwater - Water conservation: Rainwater harvesting-Conflicts over water. Mineral resources: Use - Exploitation -Environmental effects of extracting and using mineral resources - Case studies. Food resources: Effects of Modern Agriculture - Fertilizer-Pesticide problems (Eutrophication, Blue baby syndrome, Biomagnification) - Water logging - Salinity - case studies. Energy resources: Renewable (Solar, Wind) - Non renewable energy sources.

UNIT IV	**SUSTAINABILITY**	**6**

Introduction, Need and concept of sustainability, Social- Environmental and Economic Sustainability Concepts, Sustainable Development, Challenges for Sustainable Development. Environmental legislations in India - Water Act, Air Act.

UNIT V	SUSTAINABLE HABITAT	5

Basic concepts of sustainable habitat, Environment Impact Assessment (EIA) - Procedures of EIA in India, Green Engineering, Social and technological change, Industrial Processes: Pollution Prevention, Industrial Ecology.

	Total Periods	30

Suggestive Assessment Methods

Continuous Assessment Test (100 Marks)	Formative Assessment Test	End Semester Exams
WRITTEN TEST	NA	NA

Outcomes

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

1	Demonstrate the knowledge on the interdisciplinary and holistic nature of the environment. (Remember)
2	Identify the problems related to environmental degradation. (Understand)
3	Understand the significance of natural resources on the quality of life. (Understand)
4	Identify the issues in areas of sustainability. (Remember)
5	Acquire knowledge on the concepts of sustainable habitat (Remember)

Text Books

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.

Reference Books

1. Nibin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-HillProfessional.
2.   G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

Web Resources

1.   NPTEL Lecture: https://www.youtube.com/watch?v=hihFHam_wNE
2.   NPTEL Lecture: https://www.youtube.com/watch?v=DNUYxyaYh3g

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	10	10			
UNDERSTAND	50	50			
APPLY	40	40			
ANALYZE					
EVALUATE					
CREATE					
	100	**100**			

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1 Students will be able to demonstrate the knowledge on the interdisciplinary and holistic nature of the environment.   (Remember)
1.   Describe the Multidisciplinary nature of Tirunelveli District.
2.   Demonstrate the regulation of Ecosystem
COURSE OUTCOME 2: Students will be able to identify the problems related to environmental degradation.   (Understand)
1.   Demonstrate the control measures of Air and water Pollution
2.   Account the problem and suitable remedial measures for floods in the rainy season.
COURSE OUTCOME 3: Students will be able to understand the significance of natural resources on the quality of life.   (Understand)
1.   Highlight the control and effects of deforestation.
2.   Label the role of individual in conservation of natural resources
COURSE OUTCOME 4: Students will be able to identify the issues in areas of sustainability. (Remember)
1.   Outline the term "sustainable development"
2.   Compare the major limitations of the Air act, 1972 and Water act, 1980.
COURSE OUTCOME 5: Students will be able to acquire knowledge on the concepts of sustainable habitat.   (Remember)
1.   Narrate the concept and procedure for Environment Impact Assessment.
2.   Elucidate the prevention of pollution from various industries.

		L	T	P	C
21EC4603	**LINEAR INTEGRATED CIRCUITS**	3	0	2	4

Prerequisites for the course
- Analog Electronics
- Digital Logic Design

Preamble
- The course aims at Operational Amplifier, Voltage Regulators and PLL, Analog and Digital Conversion using IC741. Experiments explore design of Schmitt Trigger, Monostable and Astable Multivibrator, Filters, Differentiator and Integarator.

UNIT I	OPERATIONAL AMPLIFIER	8

Manufacturing process of monolithic ICs – Construction of monolithic bipolar transistor – Monolithic Capacitors – Inductors. Differential gain – CMRR, General operational amplifier stages – internal circuit diagrams of IC 741 – DC and AC performance characteristics – slew rate operational amplifier.

UNIT II	APPLICATIONS OF OPERATIONAL AMPLIFIERS	8

Advantages of ICs over discrete components – Open and closed loop configurations- Sign Changer – Scale Changer –Voltage Follower – Adder – Subtractor – Instrumentation amplifier – Integrator – Differentiator – Low–pass, High–pass and Band–pass filters - Comparators – Schmitt trigger – Multivibrators –V to I and I to V converters.

UNIT III	VOLTAGE REGULATORS AND PLL	8

Timer IC 555 –Timer applications – LM317 Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator– Switching Regulators, Monolithic switching regulator Operation of the basic PLL – Closed loop analysis – Voltage controlled oscillator – Monolithic PLL IC 565 – application of PLL for AM detection – FM detection – Frequency synthesizing.

UNIT IV	ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS	8

Analog and Digital Data Conversions – specifications – D/A converter– weighted resistor type, R–2R Ladder type – Voltage Mode and Current Mode– high speed sample–and–hold circuits – A/D Converters– Flash type – Counter type-Successive Approximation type – Single Slope, Dual Slope

UNIT V	ANALOG MULTIPLIER AND SPECIAL FUNCTION ICS	8

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique – analog multiplier and phase detection, DC-DC converters– Switched capacitor filter IC MF10 – Frequency to Voltage and Voltage to Frequency converters – Audio Power amplifier – Video Amplifier, ASLKv2010 Features.

	Total Periods	**40**

LABORATORY

S.NO	NAME OF THE EXPERIMENTS	HOURS	CO
1.	Design and Testing of Inverting and Non Inverting amplifier using Op amp IC 741.	2 hours	1
2.	Design and Testing of Integrator and Differentiator using Op amp IC 741.	2 hours	1
3.	Design a circuit for Active LPF, HPF and BPF using Op amp IC 741.	2 hours	2
4.	Design and Testing of Astable Multivibrator using IC 741	2 hours	2
5.	Design and Testing of Monostable Multivibrator using IC 741	2 hours	2
6.	Design and Testing of Schmitt Trigger using Op amp IC 741	2 hours	3
7.	Construct a circuit of Astable Multivibrator using IC 555.	2 hours	3
8.	Construct a circuit of Monostable Multivibrator using IC 555.	2 hours	3
9.	Design and testing of R-2R Ladder Type D- A Converter using Op-amp IC 741.	2 hours	4
10.	Simulate the experiments Active LPF and HPF, Astable and Monostable Multivibrator using IC 555.	2 hours	5
	Total Periods	**20**	

Suggestive Assessment Methods		
Continuous Assessment Test (20 Marks)	**Formative Assessment Test (20 Marks)**	**End Semester Exams (60 Marks)**

#MCQ #Mini projects #Experiments # Objective #Descriptive Answers	#Quiz #MCQ #Open Book Test #Seminar #Debate #Working Model	#MCQ #Objective #Projects #Descriptive Answers

Outcomes

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

CO1	Analyze the open and closed loop configuration and AC, DC Characteristics of an op–amp.
CO2	Apply the concept of op amp characteristics in different operational applications
CO3	Use analog multiplier and PLL for detection of modulated signals.
CO4	Design various ADC and DAC converters based on the specifications.
CO5	Design special function ICs

Text Books

1. S.Salivahanan& V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", 3rd Edition, TMH, 2015.
2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd.,4th Edition, 2015.

Reference Books

1. Ramakant A.Gayakwad, "OP–AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2001.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", 3rd Edition, Tata McGraw–Hill, 2007.
3. B.S.Sonde, "System design using Integrated Circuits" , 2nd Edition, New Age Pub, 2001

Web Resources

1. https://www.youtube.com/watch?v=7FYHt5XviKc
2. https://www.youtube.com/watch?v=-rFOCGT7Xyw
3. https://www.youtube.com/watch?v=Nf7_PFtGd-M
4. https://www.youtube.com/watch?v=HicZcgdGxZY
5. https://www.youtube.com/watch?v=_xGqfXiUkqk

CO Vs PO Mapping and CO Vs PSO Mapping

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

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	Lab Experiment	Lab Model Exam	END SEM EXAM
REMEMBER	20		20		10

UNDERSTAND	30		30		20
APPLY	40	40	40	40	30
ANALYZE		40		40	20
EVALUATE					
CREATE	10	20	10	20	20
Total	100	100	100	100	100

COURSE LEVEL ASSESSMENT QUESTIONS
COURSE OUTCOME 1:
1. Analyze when an Op-Amp is used in a circuit for amplifying AC Signal by considering output voltage will be small signal and large signal.
2. Derive the functional parameters for an inverting mode negative feedback gain circuit with a 741op-amp in IC inverting mode, with R1=1Kohm, Rf=40Kohm and compute Af, Rif, Rof, BW, offset voltage.

COURSE OUTCOME 2:
1. With neat figures describe the circuit using Op Amps on the functioning of
   (i) Integrator and double integrator circuit
   (ii) First order High pass Filter
2. Determine the output voltage V_0 and the current I_0 in the circuit as shown below.
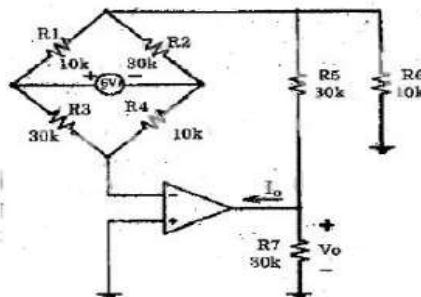
3. Assume that an op-amp has $I_{B1} = 400$ nA and $I_{B2} = 300$ nA. Determine the average bias current IB and the offset current IOS.

COURSE OUTCOME 3:
1. Summarise the working principle of IC 723 general purpose voltage regulators.
2. Design and draw the wave forms of 1KHZ square wave form generator using 555Timer for duty cycle i) D=25% ii) D=50%

COURSE OUTCOME 4:
1. Describe the working of Weighted resistor and R-2R Ladder DAC in detail.
2. Design Flash and Successive approximation ADC in detail.

COURSE OUTCOME 5:
1. Analyze the four variable transconductance amplifier Technique.

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF HOURS	Mapped with Pos

	UNIT I – OPERATIONAL AMPLIFIERS		
1	Manufacturing process of monolithic ICs – Construction of monolithic bipolar transistor	1	1,6,7
2	Monolithic Capacitors – Inductors	1	1
3	Differential gain – CMRR, General operational amplifier stages	1	1,2,3,4
4	Internal circuit diagrams of IC 741	2	1,3
5	DC and AC performance characteristics- Slew rate operational amplifier	3	1,2,3
	UNIT-II APPLICATIONS OF OPERATIONAL AMPLIFIERS		
6	Advantages of ICs over discrete components – Open and closed loop configurations	1	1
7	Sign Changer – Scale Changer –Voltage Follower	1	2,3
8	Adder – Subtractor – Instrumentation amplifier - Integrator	2	1,2,3,4
9	Differentiator – Low–pass, High–pass and Band–pass filters	1	1,2,3,4
10	Comparators – Schmitt trigger	2	1,2,3,4
11	Multivibrators – V to I and I to V converters	1	1,2,3,4
	UNIT-III VOLTAGE REGULATORS AND PLL		
12	Timer IC 555 –Timer applications	2	1,3
13	LM317 Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator	2	1,2
14	Switching Regulators	1	1
15	Monolithic switching regulator, Operation of the basic PLL	1	1,3
16	Closed loop analysis – Voltage controlled oscillator	1	1,3
	Application of PLL for AM detection – FM detection – Frequency synthesizing.	1	1,3
	UNIT-IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS		
18	Analog and Digital Data Conversions – specifications– D/A converter– weighted resistor type	1	1,2,3
19	R–2R Ladder type	1	1,2,3
20	Voltage Mode and Current Mode - high speed sample–and–	1	1,2

	hold circuits		
21	A/D Converters– Flash type	1	1,2,3
22	Counter type-Successive Approximation type	2	1,2,3
23	Single Slope, Dual Slope	2	1,2,3
UNIT-V ANALOG MULTIPLIER AND SPECIAL FUNCTION ICS			
24	Analog Multiplier using Emitter Coupled Transistor	2	1,2,3,4
25	Gilbert Multiplier cell – Variable transconductance technique	1	1,2,3,4
26	Pair analog multiplier and phase detection, DC-DC converters	1	1,2,3
27	Switched capacitor filter IC MF10 – Frequency to Voltage and Voltage to Frequency converters	2	1,2,3
28	Audio Power amplifier – Video Amplifier, ASLKv2010 Features.	2	1,2,3

21EC4611	**ANALOG AND DIGITAL COMMUNICATION LABORATORY**	**L**	**T**	**P**	**C**
		0	**0**	**4**	**2**

Prerequisites for the course

- Fundamentals of Electrical, Electronics and communication
- Semiconductor Devices and Circuits

Preamble

The course "21EC4611 ANALOG AND DIGITAL COMMUNICATION LABORATORY" is offered in the fourth semester concurrent with the course on "Analog and Digital Communication Systems". The purpose of this course is to give hands on training to the students in understanding the theory of communications and practicing sessions used in analog and digital communication systems. This will improve the understanding capability of the communications and simulation capability of the communications.

S.No	List of Experiments	CO
1	Signal Sampling and reconstruction.	**CO 1**
2	AM Modulator and Demodulator	**CO 2**
3	FM Modulator and Demodulator	**CO 2**
4	Pulse Code Modulation and Demodulation	**CO 3**
5	Delta Modulation and Demodulation	**CO 3**
6	Simulation of ASK, FSK, and BPSK generation schemes	**CO 4**
7	Simulation of QPSK and QAM generation schemes	**CO 4**
8	Simulation of signal constellations of QPSK and QAM	**CO 4**
9	Simulation of ASK, FSK and BPSK detection schemes	**CO 4**
10	Communication link simulation	**CO 4**
11	Simulation of Linear Block and Cyclic error control coding schemes	**CO 5**
12	Simulation of Convolutional coding scheme	**CO 5**

S.No.	List of Projects	Related Experiment	CO
1.	Remote Industrial Security System	1,2,3	CO 1
2.	Wireless Weather Monitoring based on GSM	1,2,3	CO 2
3.	Bluetooth Controlled Electronic Home Appliances	1,2,3	CO 2
4.	Image Coding using Shannon Fano Code	5	CO 2
5.	Image Coding using Huffman Code	5	CO 3
6.	Centralized Monitoring System for Taxies	1,2,3	CO 3
7.	Zigbee Based Defense Robot	2,3	CO 3
8.	Wireless Power Transfer	1,2,3	CO 5
9.	TV Remote Control Jammer	1,2,3	CO 5
10.	FM Remote Encoder/Decoder Circuit	2,3	CO 5
11.	Simulation of MSK	4	CO 4
12.	Cell Phone Detector:	2,3	CO 4
13.	Simulation of DPSK	4	CO 4

Suggestive Assessment Methods

Lab Components Assessments (40 Marks)	End Semester Exams (60 Marks)
• Lab Experiment • Model Exam	• Lab Exam

Outcomes

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

CO1	Demonstrate the knowledge in sampling and reconstruct of the signal.
CO2	Demonstrate the knowledge in modulating and demodulating of signals.
CO3	Demonstrate the knowledge in various pulse coding schemes.
CO4	Simulate any digital modulation techniques.
CO5	Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system.

Laboratory Requirements

- Kits for Signal Sampling, AM, FM, PCM and DM Schemes.
- CROs – 15 Nos.
- MATLAB / SCILAB or equivalent software package for simulation experiments.
- PCs - 10 Nos.

Reference Books

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 4/e, TMH 2017.
2. S. Haykin "Digital Communications" John Wiley 2013.
3. B.P. Lathi, Zhi Ding and Hari Mohan Gupta."Modern Digital And Analog Communication Systems: Fourth Edition", 4rd edition, South Asia edition, Oxford University Press, 2017.
4. H P Hsu, Schaum Outline Series "Analog and Digital Communications" TMH 2006.

5. B.Sklar, "Digital Communications Fundamentals and Applications" 2/e Pearson Education 2007.

Web Resources

1. **https://in.mathworks.com/help/comm/ug/error-detection-and-correction.html**
2. **https://www.youtube.com/watch?v=UkdyGhle_Vc**
3. **https://www.youtube.com/watch?v=IxNCmkDsZjM**

CO Vs PO Mapping and CO Vs PSO Mapping

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

COURSE LEVEL ASSESSMENT QUESTIONS

COURSE OUTCOME 1:
1. Generate a PAM signal using PAM modulator and detect the message signal from PAM signal by using PAM demodulator.
2. Define Sampling. Generate signal Sampling and reconstruction.

COURSE OUTCOME 2:
3. Transmit a modulating signal using AM transmitter and receive the signal back using AM receiver
4. Transmit a modulating signal using FM transmitter and receiver signal.

COURSE OUTCOME 3:
1. Transmit an analog message signal in its digital form using Delta modulator and reconstruct back the original signal.
2. Generate a PCM signal using PCM modulator and detect the message signal from PCM signal by using PCM demodulator.

COURSE OUTCOME 4:
1. Generate a Frequency Shift Keying signal using MATLAB
2. Generate and Detect a QPSK signal using MATLAB

COURSE OUTCOME 5:
1. Simulation of Error control coding schemes using MATLAB
2. Simulation of Linear Block and Cyclic error control coding schemes

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS	Mapped with POs
1	Signal Sampling and reconstruction.	1	1(2),2(2),4(2)
2	AM Modulator and Demodulator	1	1(2),2(2),4(2)
3	FM Modulator and Demodulator	1	1(2),2(2),4(2)

4	Pulse Code Modulation and Demodulation	1	1(1),2(1),3(2), 4(2)
5	Delta Modulation and Demodulation	1	1(1),2(1),3(2), 4(2)
6	Simulation of ASK, FSK, and BPSK generation schemes	1	1(2),2(2),4(2)
7	Simulation of QPSK and QAM generation schemes	1	1(2),2(2),4(2)
8	Simulation of signal constellations of QPSK and QAM	1	1(2),2(2),4(2)
9	Simulation of ASK, FSK and BPSK detection schemes	1	1(2),2(2),4(2)
10	Communication link simulation	1	1(1),2(1),3(2), 4(2)
11	Simulation of Linear Block and Cyclic error control coding schemes	1	1(2),2(2),4(2)
12	Simulation of Convolutional coding scheme	1	1(2),2(2),4(2)

21PT3902	**VERBAL ABILITY**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**1**

Preamble:
This course is developed to enhance the Verbal competency of the students as Verbal Ability is commonly a part of the various competitive exams conducted. This course equips the students in all the aspects of grammar and helps to enhance comprehensive abilities and Analytical skills.

Prerequisites for the course
   ● Foundational English

Objectives
   1. To help the student understand the importance of having his language skills kept ready for effective use.
   2. To provide a host of varied opportunities for the student to hone his acquired language skills basic components, namely, Grammar, Vocabulary, Spelling and Comprehension.

Module I	**Error Identification**	**6**

Articles, Tenses, Voices, Preposition, Conjunctions, Subject-verb agreement, Adverbials.

Module II	**Sentence Structure**	**6**

Parts of speech, Simple, Complex & Compound Sentences, Direct & Indirect Speech, Kinds of Sentences, Degrees of Comparison, Clauses.

Module III	**Verbal Reasoning**	**6**

Reading Comprehension, Analogies, Synonyms & Antonyms, Idioms, One word substitutes.

Module IV	**Coherence and Cohesion**	**6**

Para-jumbles, Phrasal verbs, Modifiers, Punctuations, Misspelled words.

Module V	**Rhetorical reasoning**	**6**

Verbal syllogism, figures of speech.

Suggested Assessment Activities:
   ● MCQ test through Google forms or other online test platforms.
      Eg. JavaPoint - Verbal Ability https://www.javatpoint.com/verbal-ability

	Total Periods	30

Suggestive Assessment Methods

Formative Assessment Test (20 Marks)	Continuous Assessment Test 1 (40 Marks)	Continuous Assessment Test 2 (40 Marks)
MCQ	MCQ	MCQ

Outcomes

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

CO1: Identify the grammatical errors in a sentence.

CO2: Frame sentences using the correct syntax.

CO3: Understand the concepts stated in a sentence or paragraph and analyze using verbal reasoning.

CO4: Construct sentences logically and make the texts semantically meaningful as a whole.

CO5: Interpret and analyze texts on a deeper level.

Text Books

1. Wren, P.C., Martin, H, Prasada Rao, N.D.V. (1973–2010). High School English Grammar & Composition. New Delhi: Sultan Chand Publishers
2. Kumar, Sanjay, Pushp Latha. (2018) English Language and Communication Skills for Engineers, India: Oxford University Press.

Reference Books

1. Guptha S C, (2012) Practical English Grammar & Composition, 1 st Edition, India: Arihant Publishers
2. Steven Brown, (2011) Dorolyn Smith, Active Listening 3, 3 rd Edition, UK: Cambridge University Press.

Web Resources:

1. Indiabix : https://www.indiabix.com/online-test/verbal-ability-test/
2. All India Exams : https://www.allindiaexams.in/online-test/online-verbal-ability-test/all
3. faceprep: https://www.faceprep.in/verbal-ability/

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
1										3				
2										3				
3										3				
4										2	1			
5										2	1			

BLOOMS LEVEL ASSESSMENT PATTERN

BLOOMS CATEGORY	CAT 1	CAT 2	FAT 1	FAT 2	END SEM EXAM
REMEMBER	20	10	5	5	10
UNDERSTAND	40	20	10	10	20
APPLY	30	50	5	5	50
ANALYSE	10	20	5	5	20

EVALUATE					
CREATE					

COURSE CONTENT AND LECTURE SCHEDULE

S. No	Topics to be covered	No. of Hours Needed
MODULE I - READING AND STUDY SKILLS (6)		
1	Articles	1
2	Tenses	1
3	Voices	1
4	Preposition & Conjunctions	1
5	Subject Verb Agreement	1
6	Adverbials	1
MODULE II - INTRODUCTION TO PROFESSIONAL WRITING (6)		
7	Parts of Speech	1
8	Simple, Compound & Complex Sentences	1
9	Direct & Indirect Speech	1
10	Kinds of Sentences	1
11	Degrees of Comparison	1
12	Clauses	1
MODULE III - INTERVIEW SKILLS (6)		
12	Reading Comprehension	1
14	Analogies	1
15	Synonyms & Antonyms	1
16	Idioms	1
17	One word Substitute	1
18	One word Substitute	1
MODULE IV – REPORT WRITING I (6)		
19	Para Jumbles	1
20	Para Jumbles	1
21	Phrasal Verbs	1
22	Modifiers	1
23	Punctuation	1
24	Misspelled words	1
MODULE V - REPORT WRITING II (6)		

25	Verbal Syllogism	1
26	Verbal Syllogism	1
27	Verbal Syllogism	1
28	Figures of Speech	1
29	Figures of Speech	1
30	Figures of Speech	1