22MTC01

CALCULUS
(ECE)

Instruction	3 L+1T Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aim is to

1. To explain the Partial Derivatives and the extreme values of functions of two variables.
2. To discuss Physical interpretations of scalar and vector functions.
3. To discuss vector line, surface and volume integrals.
4. To explain the concepts of basis, dimension of vector space and matrix representation of a linear transformation.
5. To explain the solution of system of linear equations by Matrix Methods.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Determine the extreme values of functions of two variables.
2. Apply the vector differential operator to scalar and vector functions
3. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
4. Determine the basis and dimension of a vector space, compute linear transformation.
5. Apply the Matrix Methods to solve the system of linear equations

CO-PO ARTICULATION MATRIX

PO/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
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	1
CO 5	3	3	3	3	-	-	-	-	-	-	-	1

UNIT I

Partial Differentiation and Its Applications: Functions of two or more variables, Partial derivatives, Higher order partial derivatives, Total derivative, Differentiation of implicit functions, Jacobians, Taylor's expansion of functions of two variables, Maxima and minima of functions of two variables.

UNIT II

Vector Differential Calculus and multiple Integrals: Scalar and Vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities), Irrotational fields and Solenoidal fields, Double integral, Change of order of Integration and Triple integrals.

UNIT III

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

UNIT IV

Vector space: Vector space, Subspace, linear combination of vectors, linear span, row and column spaces, linear dependent, independent vectors, basis, dimension, linear transformation, invertible transformation, matrix of linear transformation, kernel and range of LT, rank and nullity of LT-rank nullity theorem(without proof), change of basis.

UNIT V

Matrices: Rank of a matrix, Echelon form, consistency of linear System of equations, Eigen values, Eigenvectors, Properties of Eigen values, Cayley-Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by linear transformation, Nature of quadratic form.

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", 5th Edition, McGraw Hill, 2013.
4. Gilbert Strang, "Introduction to linear algebra", 5th Edition, Wellesley - Cambridge press, 2016.

SUGGESTED READING:

1. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw- Hill, New Delhi, 2008.
2. R.K. Jain, S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 5th edition, 2016.
3. D. Poole, "Linear Algebra: A Modern Introduction, 2nd Edition", Brooks/ Cole, 2005.
4. Kuldeep Singh, "Linear algebra: step by step". OUP Oxford, 2013.

22CYC01

CHEMISTRY
(ECE)

Instruction	3L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aim is to

1. This syllabus helps at providing the concepts of chemical bonding and chemical kinetics to the students aspiring to become practicing engineers
2. Thermodynamic and Electrochemistry units give conceptual knowledge about processes and how they can be producing electrical energy and efficiency of systems.
3. To teach students the value of chemistry and to improve the research opportunities knowledge of stereochemistry and organic reactions is essential.
4. Water chemistry unit impart the knowledge and understand the role of chemistry in the daily life.
5. New materials lead to discovering of technologies in strategic areas for which an insight into Polymers, nanomaterials and basic drugs of modern chemistry is essential.

COURSE OUTCOMES: After completion of this course, students will be able to

At the end of the course student will be able to:

1. Identify the microscopic chemistry in terms of molecular orbitals, intermolecular forces and rate of chemical reactions.
2. Discuss the properties and processes using thermodynamic functions, electrochemical cells and their role in batteries and fuel cells.
3. Illustrate the major chemical reactions that are used in the synthesis of organic molecules.
4. Classify the various methods used in treatment of water for domestic and industrial use.
5. Outline the synthesis of various Engineering materials & Drugs.

CO-PO ARTICULATION MATRIX

PO/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
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	2	-	-	2	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	3	-	-	2	2	-	-	-	-	2
CO 5	3	2	2	-	-	2	2	-	-	-	-	2

UNIT I

Atomic and molecular structure and Chemical Kinetics:

Atomic and molecular structure: Molecular Orbital theory - atomic and molecular orbitals. Linear combination of atomic orbitals (LCAO) method. Molecular orbitals of diatomic molecules. Molecular Orbital Energy level diagrams (MOED) of diatomic molecules & molecular ions (H_2, He_2^+, N_2 , O_2 , O_2^- , CO, NO). Pi- molecular orbitals of benzene and its aromaticity.

Chemical Kinetics: Introduction, Terms involved in kinetics: rate of reaction, order & molecularity; First order reaction Characteristics: units of first order rate constant & its half-life period, second order reaction Characteristics: units of second order rate constant & its half- life period. Numericals.

UNIT II

Use of free energy in chemical equilibria

Use of free energy in chemical equilibria: Thermodynamic functions: Internal energy, entropy and free energy. Significance of entropy and free energy (criteria of spontaneity). Free energy and emf (Gibbs Helmholtz equations and its applications). Cell potentials, electrode potentials, and Reference electrodes (NHE, SCE) electrochemical series. Nernst equation and its applications. Determination of pH using combined Glass & Calomel electrode. Potentiometric Acid base & Redox Titrations. Numericals.

Battery technology: Rechargeable batteries & Fuel cells.

Lithium batteries: Introduction, construction, working and applications of Li-MnO_2 and Li-ion batteries.

Fuel Cells: Introduction, difference between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell.

UNIT III

Stereochemistry and Organic reactions

Stereochemistry: Representations of 3 dimensional structures, Types of stereoisomerism- Conformational isomerism – confirmations of n-butane (Newman and sawhorse representations), Configurational isomerism - Geometrical (cis-trans) isomerism & Optical isomerism- optical activity, Symmetry and chirality: Enantiomers (lactic acid) & Diastereomers (Tartaric acid), Absolute configurations, Sequence rules for R&S notation.

Types of Organic reactions: Substitution Reactions- Electrophilic substitution (Nitration of Benzene); Nucleophilic Substitution (S_N1& S_N2); Free Radical Substitution (Halogenation of Alkanes)

Addition Reactions: Electrophilic Addition – Markonikoff's rule, Free radical Addition - Anti Markonikoff's rule (Peroxide effect), Nucleophilic Addition – (Addition of HCN to carbonyl compounds)

Eliminations-E1 and E2 (dehydrohalogenation of alkyl halides), Cyclization (Diels - Alder reaction)

UNIT IV

Water Chemistry: Hardness of water – Types, units of hardness, Disadvantages of hard water, Alkalinity and Estimation of Alkalinity of water, Boiler troubles - scales & sludge formation, causes and effects, Softening of water by lime soda process (Cold lime soda process), ion exchange method and Reverse Osmosis. Specifications of potable water & industrial water. Disinfection of water by Chlorination; break point chlorination, BOD and COD definition, Estimation (only brief procedure) and significance, Numericals.

UNIT V

Engineering Materials and Drugs: Introduction, Terms used in polymer science; Thermoplastic polymers (PVC) &Thermosetting polymers (Bakelite); Elastomers (Natural rubber). Conducting polymers- Definition, classification and applications.

Polymers for Electronics: Polymer resists for integrated circuit fabrication, lithography and photolithography: Nano materials-Introduction to nano materials and general applications, basic chemical methods of preparation- Sol-gel method. Carbon nanotubes and their applications. Characterisation of nanomaterials by SEM and TEM (only Principle). Drugs-Introduction, Synthesis and uses of Aspirin (analgesic), Paracetamol (Antipyretic), Atenolol (antihypertensive).

TEXT BOOKS:

1. P.C. Jain and M. Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Ltd., New Delhi,16th edition (2015).
2. W.U. Malik, G.D.Tuli and R.D.Madan, "Selected topics in Inorganic Chemistry", S Chand & Company Ltd, New Delhi, reprint (2009).
3. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, "Organic Chemistry", Pearson, Delhi, 7th edition (2019).
4. A Textbook of Polymer Science and Technology , Shashi Chawla ,Dhanpat Rai & Co. (2014)
5. T. Pradeep, Nano: The Essentials, Tata McGraw-Hill Education, Delhi, 2012
6. G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, K.L.N. Reddy and C.Sudhakar, "Drugs", Universities Press (India) Limited, Hyderabad (2007).

SUGGESTED READING:

1. B. H. Mahan, "University Chemistry", Narosa Publishing house, New Delhi, 3rd edition (2013).
2. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry", S. Nagin Chand & Company Ltd., 46th edition (2013).
3. T.W. Graham Solomons, C.B. Fryhle and S.A. Snyder, "Organic Chemistry", Wiley, 12th edition (2017).
4. P.W. Atkins, J.D. Paula, "Physical Chemistry", Oxford, 8th edition (2006).

22EEC01

BASIC ELECTRICAL ENGINEERING

Instruction	3 Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

COURSE OBJECTIVES: This course aim is to

1. To understand the behaviour of different circuit elements R, L & C, and the basic concepts of electrical AC circuit analysis
2. To comprehend the basic principle of operation of AC and DC machines
3. To infer about different types of electrical wires and cables, domestic and industrial wiring, safety rules and methods of earthing.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Understand the concepts of Kirchhoff's laws and their application various theorems to get solution of simple dc circuits.
2. Predict the steady state response of RLC circuits with AC single phase/three phase supply.
3. Infer the basics of single phase transformer
4. Describe the construction, working principle of DC machine and 3-phase Induction motor.
5. Acquire the knowledge of electrical wires, cables, earthing, Electrical safety precautions to be followed in electrical installations and electric shock and its safety and energy calculations.

CO-PO ARTICULATION MATRIX

PO/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
CO-1	3	3	2	-	-	-	-	-	1	2	-	3
CO-2	3	3	2	-	-	-	-	-	1	2	-	3
CO-3	3	3	2	1	-	-	-	-	1	2	-	3
CO-4	2	1	-	-	-	-	-	-	1	2	-	3
CO-5	2	-	2	-	-	-	-	-	1	2	-	3

UNIT I

DC Circuits: Electrical circuit elements (R,L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation, Superposition, Thevenin's and Norton's Theorems.

UNIT II

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, series RL and RC. Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT III

Single Phase Transformer: Construction, Working principle, EMF Equation, Ideal and Practical transformer, Equivalent circuit of Transformer, OC and SC tests on a transformer, Efficiency and Regulation

UNIT IV

DC and AC Machines: DC Generators: Construction, Principle of operation, EMF equation, Classification, Characteristics of shunt generators. DC Motors: Classification, Torque Equation, Characteristics and Speed control of DC Shunt and Series Motors, Losses and efficiency Three - Phase Induction Motors: Principle of operation, Applications

UNIT V

Electrical Installations: Electrical Wiring: Types of wires and cables, Electrical Safety precautions in handling electrical appliances, electric shock, and first aid for electric shock, safety rules. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, Earthing (Elementary Treatment only), Elementary calculations for energy consumption

TEXT BOOKS:

1. L. S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press, 2011.
2. E. Hughes, Electrical and Electronics Technology, Pearson, 2010.

SUGGESTED READING:

1. D. P. Kothari & I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989
3. D.C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009
4. P.V. Prasad, S. Sivanagaraju, R. Prasad, "Basic Electrical and Electronics Engineering" Cengage Learning, 1st Edition, 2013

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aim is to

1. Master the fundamentals of writing Python scrips.
2. Learn Python elements such as variables, flow controls structures, and functions.
3. Discover how to work with lists and sequence data, and files.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

PO/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
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	2	3	3	2	3	-	-	-	-	-	-	1
CO4	2	3	3	2	2	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
CO6	2	3	3	3	3	-	-	-	-	-	-	1

LABORATORY / PRACTICAL EXPERIMENTS:

1. Explore various Python Program Development Environments.
2. Demonstration of input/output operations.
3. Demonstration of operators.
4. Demonstration of selective control structures.
5. Demonstration of looping control structures.
6. Demonstration of List, Tuple and Set
7. Demonstration of Python Dictionaries.
8. Implementation of searching and sorting techniques.
9. Implementation of string manipulation operations.
10. File handling and memory management operations.

TEXT BOOKS AND REFERENCES:

1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.
3. Mark Lutz, “Learning Python”, 5th Edition, , O'Reilly Media, Inc.,
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM COURSES:

1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming.

22CYC02

CHEMISTRY LAB

Instruction:	3P Hours per Week
Duration of SEE:	3 Hours
SEE:	50 Marks
Continuous Internal Evaluation:	50 Marks
Credits:	1.5

COURSE OBJECTIVES: This course aim is to

1. To impart fundamental knowledge in handling the equipment / glassware and chemicals in chemistry laboratory.
2. To provide the knowledge in both qualitative and quantitative chemical analysis
3. The student should be conversant with the principles of volumetric analysis
4. To apply various instrumental methods to analyse the chemical compounds and to improve understanding of theoretical concepts.
5. To interpret the theorical concepts in the preparation of new materials like drugs and polymers.

COURSE OUTCOMES: At the end of the course, student will be able to

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Estimate the amount of chemical substances by volumetric analysis.
3. Determine the rate constants of reactions from concentration of reactants/ products as a function of time.
4. Calculate the concentration and amount of various substances using instrumental techniques.
5. Develop the basic drug molecules and polymeric compounds.

CO-PO ARTICULATION MATRIX

PO/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
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Introduction: Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Estimation of metal ions (Co^{+2} & Ni^{+2}) by EDTA method.
3. Estimation of temporary and permanent hardness of water using EDTA solution
4. Determination of Alkalinity of water
5. Determination of rate constant for the reaction of hydrolysis of methyl acetate. (first order)
6. Determination of rate constant for the reaction between potassium per sulphate and potassium Iodide. (second order)
7. Estimation of amount of HCl Conductometrically using NaOH solution.
8. Estimation of amount of HCl and CH_3COOH present in the given mixture of acids Conductometrically using NaOH solution.
9. Estimation of amount of HCl Potentiometrically using NaOH solution.
10. Estimation of amount of Fe^{+2} Potentiometrically using $KMnO_4$ solution.
11. Preparation of Nitrobenzene from Benzene.
12. Synthesis of Aspirin drug and Paracetamol drug.
13. Synthesis of phenol formaldehyde resin.

TEXT BOOKS:

1. J. Mendham and Thomas, "Vogel's text book of quantitative chemical analysis", Pearson education Pvt.Ltd. New Delhi , 6th ed. 2002.
2. Senior practical physical chemistry by B.D.Khosla, V.C.Garg & A.Gulati,; R. Chand & Co. : New Delhi (2011).

SUGGESTED READINGS:

1. Dr. Subdharani, "Laboratory Manual on Engineering Chemistry", Dhanpat Rai Publishing, 2012.
2. S.S. Dara, "A Textbook on experiment and calculation in engineering chemistry", S.Chand and Company, 9th revised edition, 2015.

22MBC02

COMMUNITY ENGAGEMENT

Instruction	3P Hours per week
SEE	Nil
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aim is to

1. Develop an appreciation of Rural culture, life-style and wisdom among the Students.
2. Learn about the various livelihood activities that contribute to Rural economy.
3. Familiarize the Rural Institutions and the Rural Development Programmes in India.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Gain an understanding of Rural life, Culture and Social realities.
2. Develop a sense of empathy and bonds of mutuality with Local Communities.
3. Appreciate significant contributions of Local communities to Indian Society and Economy.
4. Exhibit the knowledge of Rural Institutions and contributing to Community's Socio Economic improvements.
5. Utilise the opportunities provided by Rural Development Programmes.

Module I

Appreciation of Rural Society: Rural life style, Rural society, Caste and Gender relations, Rural values with respect to Community, Nature and Resources, elaboration of 'soul of India lies in villages' (Gandhi), Rural Infrastructure.

Module II

Understanding Rural Economy and Livelihood: Agriculture, Farming, Landownership, Water management, Animal Husbandry, Non-farm Livelihood and Artisans, Rural Entrepreneurs, Rural markets, Rural Credit Societies, Farmer Production Organization/Company.

Module III

Rural Institutions: Traditional Rural organizations, Self-Help Groups, Panchayati Raj Institutions (Gram Sabha), Gram Panchayat, Standing Committees, Local Civil Society, Local Administration.

Module IV

Rural Development Programmes: History of Rural Development in India, Current National Programmes: Sarva Shiksha Abhiyan, Beti Bhachao, Beti Padhao, Ayushman, Bharat, Swachh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA etc.

TEXT BOOKS:

1. Singh, Katar, Rural Development: Principles, Policies and Management, Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, Sustainable Development Goals, 2015, un.org/sdgs
4. M.P Boraia, Best Practices in Rural Development, Shanlax Publishers, 2016.

JOURNALS:

1. Journal of Rural development (published by NIRD & PR, Hyderabad).
2. Indian Journal of Social Work, (by TISS, Bombay).
3. Indian Journal of Extension Educations (by Indian Society of Extension Education).
4. Journal of Extension Education (by Extension Education Society).
5. Kurukshetra (Ministry of Rural Development, GOI).
6. Yojana (Ministry of Information & Broadcasting, GOI).

22CSC02

PROBLEM SOLVING AND PROGRAMMING LAB

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: This course aim is to

1. Master the fundamentals of writing Python scrips.
2. Learn Python elements such as variables, flow controls structures, and functions.
3. Discover how to work with lists and sequence data, and files.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Understand various Python program development Environments.
2. Demonstrate the concepts of Python.
3. Implement algorithms/flowcharts using Python to solve real-world problems.
4. Build and manage dictionaries to manage data.
5. Write Python functions to facilitate code reuse.
6. Use Python to handle files and memory.

CO-PO ARTICULATION MATRIX

PO/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
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	3	2	2	3	-	-	-	-	-	-	1
CO3	2	3	3	2	3	-	-	-	-	-	-	1
CO4	2	3	3	2	2	-	-	-	-	-	-	1
CO5	2	3	3	3	3	-	-	-	-	-	-	1
CO6	2	3	3	3	3	-	-	-	-	-	-	1

LABORATORY / PRACTICAL EXPERIMENTS:

11. Explore various Python Program Development Environments.
12. Demonstration of input/output operations.
13. Demonstration of operators.
14. Demonstration of selective control structures.
15. Demonstration of looping control structures.
16. Demonstration of List, Tuple and Set
17. Demonstration of Python Dictionaries.
18. Implementation of searching and sorting techniques.
19. Implementation of string manipulation operations.
20. File handling and memory management operations.

TEXT BOOKS AND REFERENCES:

1. R.S. Salaria, “Programming for Problem Solving”, First Edition, Khanna Book Publishing Co., Delhi.
2. Jeeva Jose, “Taming Python by Programming”, Revised Edition, Khanna Book Publishing Co., Delhi.
3. Mark Lutz, “Learning Python”, 5th Edition, , O'Reilly Media, Inc.,
4. Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.
5. “Programming in Python”, R.S. Salaria, Khanna Book Publishing Co., Delhi.

NPTEL/SWAYAM Courses:

1. Introduction to Problem Solving and Programming, Video Lectures, Prof. D Gupta, IIT Delhi.
2. Problem Solving Aspects and Python Programming, Dr. S Malinga, Dr Thangarajan, Dr. S V Kogilavani, Kongu Engineering College.
3. https://www.coursera.org/specializations/python-3-programming.

22MEC37

ROBOTICS AND DRONES LAB

(Common to All Branches)

Instruction	2T + 2P Hours per week
CIE	100 Marks
Credits	3

COURSE OBJECTIVES: This course aim is to

1. To develop the students' knowledge in various robot and drone structures and their workspace.
2. To develop multidisciplinary robotics that have practical importance by participating in robotics competitions
3. To develop students' skills in performing spatial transformations associated with rigid body motions, kinematic and dynamitic analysis of robot systems.
4. Through projects done in lab, increase the true hands-on student learning experience and enhance their conceptual understanding, increase students' ability, competence and teamwork skills on dealing with real-life engineering problems

COURSE OUTCOMES: After completion of this course, students will be able to

1. Demonstrate knowledge of the relationship between mechanical structures of robotics and their operational workspace characteristics
2. Understand mechanical components, motors, sensors and electronic circuits of robots and build robots.
3. Demonstrate knowledge of robot controllers.
4. Use Linux environment for robotic programming.
5. Write Python scripts to control robots using Python and Open CV.

COURSE ARTICULATION MATRIX

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

LIST OF EXPERIMENTS:

1. Assembling of robot mechanical components, mounting of motors, sensors, electronic circuits to the chassis.
2. Connecting to electronic circuitry: motor drivers, incremental encoders proximity sensors, micro controller,
3. Different types of batteries, selection of suitable battery for application, safety precaution.
4. Introduction to Linux Command Line Interface: basic file and directory management and other useful commands
5. Controlling robot using Python: i) Move robot using Python code, ii) Make robot move in patterns using Python
6. Robot programming with Sensor inputs: i) Read sensor data using Python, ii) Visualize sensor data using Python, iii) Code robot to avoid obstacles by using sensor data
7. Open CV: i) Create an Image and display an image; ii) Read and change pixel values; iii) Create colored shapes and save image; iv) Extract the RGB values of a pixel; v) Reading and Writing Videos
8. Open CV: i) Extraction of Regions of Interest; ii) Extraction of RGB values of a pixel
9. Coding robot to work with colors, follow colored objects, identifying shape of the object-oriented
10. Projects: i)Making a line follower robot using a Camera; ii) Writing code for a complex function Assembly of a drone

SUGGESTED READINGS:

1. https://www.geeksforgeeks.org/robotics-introduction/
2. https://www.ohio.edu/mechanical-faculty/williams/html/PDF/IntroRob.pdf
3. https://www.idtechex.com/en/research-report/new-robotics-and-drones-2018-2038-technologies-forecasts-players/584
4. https://dronebotworkshop.com/

HEAD
DEPARTMENT OF ECE
Chaitanya Bharathi Institute of Technolog
Hyderabad-500 075

22EEC02

BASIC ELECTRICAL ENGINEERING LAB

Instruction	2P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

COURSE OBJECTIVES: This course aim is to

1. To acquire the knowledge on different types of electrical elements and to verify the basic electrical circuit laws and theorems.
2. To determine the parameters and power factor of a coil, calculate the time and frequency responses of RLC circuits and to familiarize with measurement of electric power & energy.
3. To determine the characteristics of Transformers, dc, ac machines and switch gear components

COURSE OUTCOMES: After completion of this course, students will be able to

1. Comprehend the circuit analysis techniques using various circuital laws and theorems.
2. Analyse the parameters of the given coil and measurement of power and energy in AC circuits
3. Determine the turns ration/performance parameters of single-phase transformer
4. Infer the characteristics of DC shunt motor different tests.
5. Illustrate different parts and their function of electrical components, equipment and machines.

CO-PO ARTICULATION MATRIX

PO/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
CO 1	3	2	2	-	-	2	2	-	-	-	-	2
CO 2	3	2	1	-	-	1	2	-	-	-	-	2
CO 3	3	2	3	-	-	2	2	-	-	-	-	2
CO 4	3	2	2	-	-	2	2	-	-	-	-	2
CO 5	3	2	3	-	-	2	2	-	-	-	-	2

LIST OF LABORATORY EXPERIMENTS/DEMONSTRATIONS:

1. Verification of KCL and KVL.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Charging and discharging of Capacitor.
5. Determination of parameters of a choke or coil by Wattmeter Method.
6. Power factor improvem
7. ent of single-phase AC System.
8. Active and Reactive Power measurement of a single-phase system using

a. 3-Ammeter method b. 3-Voltmeter method

9. Measurement of 3-Phase Power in a balanced system
10. Calibration of single-phase energy meter.
11. Verification of Turns/voltage ratio of single-phase Transformer.
12. Open Circuit and Short Circuit tests on a given single phase Transformer.
13. Brake test on DC Shunt Motor
14. Speed control of DC Shunt Motor.
15. Demonstration of Measuring Instruments and Electrical Lab components.
16. Demonstration of Low-Tension Switchgear Equipment/Components.
17. Demonstration of cut - out section of Machines like DC Machine, Induction Machine etc.

Note: TEN experiments to be conducted to cover all five Course Outcomes.

22MTC05

VECTOR CALCULUS AND DIFFERENTIAL EQUATIONS
(ECE)

Instruction	3 L+1T per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aim is to

1. To explain scalar and vector functions with its Physical interpretations.
2. To discuss vector line, surface and volume integrals.
3. To explain relevant methods to solve first order differential equations.
4. To discuss the solution of higher order Differential Equations
5. To learn Numerical solution of ODE and Engineering problems.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Apply the vector differential operators to Scalars and Vector functions.
2. Solve line, surface & volume integrals by Greens, Gauss and Stoke's theorems.
3. Calculate the solutions of first order linear differential equations.
4. Solve higher order linear differential equations.
5. Find solution of algebraic, transcendental and ODE by Numerical Methods.

CO-PO ARTICULATION MATRIX

PO/PSO 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
CO 1	3	3	3	3	-	-	-	-	-	-	-	2
CO 2	3	3	3	3	-	-	-	-	-	-	-	2
CO 3	3	3	3	3	-	-	-	-	-	-	-	2
CO 4	3	3	3	3	-	-	-	-	-	-	-	2
CO 5	2	2	2	2	-	-	-	-	-	-	-	1

UNIT I

Vector Differential Calculus and multiple Integrals: Scalar and Vector point functions, vector operator Del, Gradient, Directional derivative, Divergence, Curl, Del applied twice to point functions, Del applied to product of point functions (vector identities), Irrotational fields and Solenoidal fields, Double integral, Change of order of Integration and Triple integrals.

UNIT II

Vector Integral Calculus: Line integral, Surface integral and Volume integral. Verification of Green's theorem in a plane (without proof), verification of Stroke's theorem (without proof) and Gauss's divergence theorem (without proof).

UNIT III

First Order Ordinary Differential Equations: Exact differential equations, Equations reducible to exact equations, Linear equation, Bernoulli's equation, Clairaut's equation, Riccati's equation, Orthogonal trajectories, Rate of decay of Radio-active materials**.**

UNIT IV

Higher Orders Linear Differential Equations: Higher order linear differential equations with constant coefficients, rules for finding Complementary function, Particular Integral and General solution. Method of variation of parameters, solution of Cauchy- Euler equation, LR and LCR circuits

UNIT V

Numerical Methods: Solution of Algebraic and transcendental equations by Bisection method, Regula-Falsi method Newton-Raphson method. Numerical Solutions of First Order Ordinary differential equations by Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta method of fourth order.

TEXT BOOKS:

1. B.S.Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.

SUGGESTED READING:

1. N.P.Bali and Dr. Manish Goyal, "A text book of Engineering Mathematics", 9th edition, Laxmi Publications, 2017.
2. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th edition, Narosa Publications, 2016.

22PYC01

OPTICS AND SEMICONDUCTOR PHYSICS

Instruction	3L Hours per week
Duration of SEE	3Hours
SEE	60Marks
CIE	40Marks
Credits	3

COURSE OBJECTIVES: This course aim is to
1. Understand the fundamentals of wave nature of light
2. Acquire knowledge of lasers, holography and fiber optics
3. Familiarize with quantum mechanics
4. Learn the fundamental concepts of solids

COURSE OUTCOMES: After completion of this course, students will be able to
1. Demonstrate the physical properties of light.
2. Explain characteristic properties of lasers and fiber optics
3. Find the applications of quantum mechanics
4. Classify the solids depending upon electrical conductivity
5. Identify different types of semiconductors

CO-PO ARTICULATION MATRIX

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

UNIT I

Wave Optics: Huygen's principle –Super position of waves –Interference of light by wave front splitting and amplitude splitting–Fresnel's biprism – Interference in thin films in reflected light– Newton's rings– Fraunhofer diffraction from a single slit –Double slit diffraction – Rayleigh criterion for limit of resolution– Concept of N-slits–Diffraction grating and its resolving power.

UNIT II

Lasers & Holography: Characteristics of lasers – Einstein's coefficients –Amplification of light by population inversion –Different types of lasers: solid-state lasers: Ruby & Nd:YAG; gas lasers: He-Ne & CO_2; semiconductor laser – Applications of lasers in engineering and medicine. Holography: Principle – Recording and reconstruction– Applications.

Fiber Optics: Introduction – Construction – Principle – Propagation of light through an optical fiber – Numerical aperture and acceptance angle –Step-index and graded-index fibers –Pulse dispersion –Fiberlosses--Fiber optic communication system –Applications.

UNIT III

Principles of Quantum Mechanics: Introduction – Wave nature of particles – de-Broglie hypothesis – Physical significance of ψ – Time-dependent and time-independent Schrodinger equations – Born interpretation – Probability current –Wave packets –Uncertainty principle –Particle in infinite square well potential –Scattering from potential step – Potential barrier and tunneling.

UNIT IV

Band Theory of Solids: Salient features of free electron theory of metals (Classical and Quantum) – Fermi level –Density of states – Bloch's theorem for particles in a periodic potential – Kronig-Penney model – Classification of solids: metals, semiconductors and insulators.

UNIT V

Semiconductors: Intrinsic and extrinsic semiconductors – Charge carrier concentration in intrinsic semiconductors – Dependence of Fermi level on carrier concentration and temperature in extrinsic semiconductors (qualitative) – Carrier generation and recombination – Carrier transport: diffusion and drift – P-N junction – Thermistor – Hall Effect – LED – Solar cell.

TEXT BOOKS:

1. B. K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Publications, 2012.
2. M. N. Avadhanulu and P. G. Kshirsagar, *A Text Book of Engineering Physics*, S. Chand Publications, 2014.
3. M. Arumugam, *Materials Science*, Anuradha Publications, 2015.
4. S. L. Gupta and Sanjeev Gupta, *Modern Engineering Physics*, Dhanpat Rai Publications, 2011.

SUGGESTD READING:

1. R. Murugeshan and Kiruthiga Sivaprasath, *Modern Physics*, S. Chand Publications, 2014.
2. V. Rajendran, *Engineering Physics*, Mc Graw-Hill Education Publications, 2013.
3. P. K. Palanisamy, *Engineering Physics*, Scitech Publications, 2012.
4. V. Raghavan, *Materials Science and Engineering*, Prentice Hall India Learning Private Limited; 6th Revised edition, 2015.

22CEC01

ENGINEERING MECHANICS

Instruction	3L+1T Periods per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	4

COURSE OBJECTIVES: This course aim is to

1. Understand the resolution of forces and to obtain resultant of all force systems,
2. Understand equilibrium conditions of static loads for smooth and frictional surface
3. Analyse simple trusses for forces in various members of a truss
4. Obtain centroid, centre of gravity for various regular and composite areas and bodies
5. Obtain Moment of inertia for various regular and composite areas and bodies and also to obtain Mass moments of inertia of elementary bodies

COURSE OUTCOMES: After completion of this course, students will be able to

1. Calculate the components and resultant of coplanar forces system and Draw free body diagrams to analyze the forces in the given structure
2. Understand the mechanism of friction and can solve friction problems
3. Analyse simple trusses for forces in various members of a truss.
4. Determine the centroid of plane areas, composite areas and centres of gravity of bodies.
5. Determine moments of inertia, product of inertia of plane and composite areas and mass moments of inertia of elementary bodies,

CO-PO ARTICULATION MATRIX

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

UNIT I

Resolution and Resultant of Force System: Basic concepts of a force system. Components of forces in a plane. Resultant of coplanar concurrent force system. Moment of a force, couple and their applications. Resultant of coplanar non-concurrent force system

Equilibrium of force system: Free body diagrams, equations of equilibrium of planar force systems and its applications. Problems on general case of coplanar force systems.

UNIT II

Theory of friction: Introduction, types of friction, laws of friction, application of friction to a single body & connecting systems. Wedge and belt friction

UNIT III

Analysis of Simple Trusses: Introduction to trusses, Assumptions, analysis of simple trusses using method of joints and method of sections.

UNIT IV

Centroid: Significance of centroid, moment of area, centroid of line elements, plane areas, composite areas, theorems of Pappus & its applications. Center of gravity of elementary and composite bodies

UNIT V

Moment of Inertia: Definition of MI, Area MI. Polar Moment of Inertia, radius of gyration, transfer theorem, Moment of Inertia of elementary & composite areas, and Product of inertia. Mass moments of inertia of elementary bodies.

TEXT BOOKS:

1. K. Vijay Kumar Reddy and J. Suresh Kumar, Singer's Engineering Mechanics, BS Publications, Hyderabad, 2011.
2. Ferdinand L Singer, Engineering Mechanics, Harper and Collins, Singapore, 1904.

SUGGESTED READING:

1. A. Nelson, Engineering Mechanics, Tata McGraw Hill, New Delhi, 2010.
2. S. Rajashekaran & G. Sankarasubramanyam, Engineering Mechanics, Vikas publications, Hyderabad, 2002.
3. S.B. Junarkar and H.J Shah, Applied Mechanics**,** Charotar publishers, New Delhi, 2001.
4. Basudeb Bhattacharyya, Engineering Mechanics, Oxford University Press, New Delhi, 2008.
5. A K Tayal, Engineering Mechanics, Umesh Publications, New Delhi, 2010

22EGC01

ENGLISH

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

PREREQUISITE: Basic knowledge of English grammar and vocabulary.

COURSE OBJECTIVES: This course aim is to
1. To the role and importance of communication while developing their basic communication skills in English.
2. To basics of writing coherent paragraphs and formal Emails.
3. To techniques of writing a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. To description, definition and classification of processes while enabling them to draft formal reports following a proper structure.
5. To gaining adequate reading comprehension techniques.

COURSE OUTCOMES: After completion of this course, students will be able to
1. Illustrate the nature, process and types of communication and communicate effectively without barriers.
2. Construct and compose coherent paragraphs, emails and adhering to appropriate mobile etiquette.
3. Apply techniques of precision to write a précis and formal letters by using acceptable grammar and appropriate vocabulary.
4. Distinguish formal from informal reports and demonstrate advanced writing skills by drafting formal reports.
5. Critique passages by applying effective reading techniques.

CO-PO-PSO ARTICULATION MATRIX

PO/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
CO 1	1	1	1	1	1	1	1	2	3	3	2	3
CO 2	1	1	1	1	-	1	1	1	2	2	1	2
CO 3	-	2	1	1	-	2	1	1	2	2	1	2
CO 4	1	2	1	2	1	2	2	1	2	2	1	2
CO 5	1	2	1	2	1	1	1	1	1	2	1	2

UNIT I

Understanding Communication in English: Introduction, nature and importance of communication; Process of communication; Types of communication - verbal and non-verbal; Barriers to communication; Intrapersonal and interpersonal communication; Understanding Johari Window.

Vocabulary &Grammar: The concept of Word Formation; Use of appropriate prepositions and articles.

UNIT II

Developing Writing Skills I: Paragraph writing. – Structure and features of a paragraph; Cohesion and coherence. Rearranging jumbled sentences. Email and Mobile etiquette.

Vocabulary & Grammar: Use of cohesive devices and correct punctuation.

UNIT III

Developing Writing Skills II: Précis Writing; Techniques of writing precisely. Letter Writing – Structure, format of a formal letter; Letter of request and the response.

Vocabulary and Grammar: Subject-verb agreement. Use of prefixes and suffixes to form derivatives. Avoiding redundancies.

UNIT IV

Developing Writing Skills III: Report writing – Importance, structure, elements of style of formal reports; Writing a formal report.

Vocabulary and Grammar: Avoiding ambiguity - Misplaced modifiers. Use of synonyms and antonyms.

UNIT V

Developing Reading Skills: The reading process, purpose, different kinds of texts; Reading comprehension; Techniques of comprehension – skimming, scanning, drawing inferences and conclusions.

Vocabulary and Grammar: Words often Confused; Use of standard abbreviations.

TEXT BOOKS:

1. "Language and Life: A Skills Approach", Board of Editors, 2018th Edition, Orient Black Swan, 2018.
2. Swan Michael, "Practical English Usage", OUP, 1995.

SUGGESTED READING:

1. Wood F.T, "Remedial English Grammar", Macmillan, 2007.
2. Zinsser William, "On Writing Well", Harper Resource Book, 2001.
3. Sanjay Kumar and Pushp Lata, "Communication Skills", Oxford University Press, 2011.

22PYC09

ELECTROMAGNETIC THEORY AND QUANTUM MECHANICS LAB (ECE & EEE)

Instruction	3P Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	1.5

COURSE OBJECTIVES: This course aim is to

1. Apply the concepts of physics while doing experiments
2. Understand the nature of the light experimentally
3. Analyzethebehaviourofsemiconductormaterialsandoptoelectronicdevices

COURSE OUTCOMES: After completion of this course, students will be able to

1. Experiment with the concept of errors and find the ways to minimize the errors
2. Demonstrate properties of light experimentally
3. Find the applications of lasers and optical fibers in engineering applications
4. Make use of semiconductor devices for practical applications
5. Illustrate the working of optoelectronic devices

CO-PO ARTICULATION MATRIX

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

LIST OF EXPERIMENTS:

1. Error Analysis : Estimation of errors in the determination of time period of a torsional pendulum
2. Newton's Rings : Determination of wavelength of given monochromatic source
3. Single Slit Diffraction : Determination of wavelength of given monochromatic source
4. Diffraction Grating : Determination of wavelengths of two yellow lines of light of mercury lamp
5. Malus's Law : Verification of Malus's law
6. Double Refraction : Determination of refractive indices of O-ray and E-ray of given calcite crystal
7. Polarimeter : Determination of specific rotation of glucose
8. Laser : Determination of wavelength of given semiconductor laser
9. Optical Fiber : Determination of numerical aperture and power losses of given optical fiber
10. Energy Gap : Determination of energy gap of given semiconductor
11. P-N Junction Diode : Study of V-I characteristics and calculation of resistance of given diode in forward bias and reverse bias
12. Thermistor : Determination of temperature coefficient of resistance of given thermistor
13. Hall Effect : Determination of Hall coefficient, carrier concentration and mobility of charge carriers of given semiconductor specimen
14. LED : Study of I-V characteristics of given LED
15. Solar Cell : Study of I-V characteristics of given solar cell and calculation of fill factor, efficiency and series resistance

NOTE: A minimum of TWELVE experiments should be done.

22EGC02

ENGLISH LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

PREREQUISITE: Basic Knowledge of English Communication.

COURSE OBJECTIVES: This course aim is to

1. To nuances of Phonetics and give them sufficient practice in correct pronunciation.
2. To word stress and intonation.
3. To IELTS and TOEFL material for honing their listening skills.
4. To activities enabling them overcome their inhibitions while speaking in English with the focus being on fluency rather than accuracy.
5. To team work, role behaviour while developing their ability to discuss in groups and making oral presentations.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Define the speech sounds in English and understand the nuances of pronunciation in English.
2. Apply stress correctly and speak with the proper tone, intonation and rhythm.
3. Analyze IELTS and TOEFL listening comprehension texts to enhance their listening skills.
4. Determine the context and speak appropriately in various situations.
5. Design and present effective posters while working in teams, and discuss and participate in Group discussions.

CO-PO-PSO ARTICULATION MATRIX

PO/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
CO 1	-	-	-	-	-	-	-	-	1	1	-	1
CO 2	-	-	-	-	-	1	-	1	2	2	1	2
CO 3	-	-	-	-	-	1	1	1	2	1	1	2
CO 4	1	-	-	-	-	1	2	2	2	3	1	3
CO 5	1	1	1	1	1	2	2	2	3	3	2	3

LIST OF EXERCISES:

1. **Introduction to English Phonetics**: Introduction to auditory, acoustic and articulatory phonetics, organs of speech: the respiratory, articulatory and phonatory systems.
2. **Sound system of English**: Phonetic sounds and phonemic sounds, introduction to International Phonetic Alphabet, classification and description of English phonemic sounds, minimal pairs. The syllable: types of syllables, consonant clusters.
3. **Word stress**: Primary stress, secondary stress, functional stress, rules of word stress.
4. **Rhythm & Intonation**: Introduction to Rhythm and Intonation. Major patterns, intonation of English with the semantic implications.
5. **Listening skills** – Practice with IELTS and TOEFL material.
6. **Public speaking –** Speaking with confidence and clarity in different contexts on various issues.
7. **Group Discussions -** Dynamics of a group discussion, group discussion techniques, body language.
8. **Pictionary –** weaving an imaginative story around a given picture.
9. **Information Gap Activity –** Writing a brief report on a newspaper headline by building on the hints given.
10. **Poster presentation –** Theme, poster preparation, team work and e presentation.

SUGGESTED READING:

1. T Balasubramanian, “A Textbook of English Phonetics for Indian Students”, Macmillan, 2008.
2. J Sethi et al., “A Practical Course in English Pronunciation (with CD)”, Prentice Hall India, 2005.
3. Priyadarshi Patnaik, “Group Discussions and Interviews”, Cambridge University Press Pvt. Ltd., 2011.
4. Aruna Koneru, “Professional Speaking Skills”, Oxford University Press, 2016.

22MEC01

CAD AND DRAFTING

Instruction	1T+3D Hours per week
Duration of SEE	3Hours
SEE	50Marks
CIE	50Marks
Credits	2.5

COURSE OBJECTIVES: This course aim is to

1. To get exposure to a cad package and its utility.
2. Understanding orthographic projections.
3. To visualize different solids and their sections in orthographic projection
4. To prepare the student to communicate effectively by using isometric projection.
5. To prepare the student to use the techniques, skills, and modern tools necessary for practice.

COURSE OUTCOMES: After completion of this course, students will be able to

1. Become conversant with appropriate use of CAD software for drafting.
2. Recognize BIS, ISO Standards and conventions in Engineering Drafting.
3. Construct the projections of points, lines, planes, solids
4. Analyse the internal details of solids through sectional views
5. Create an isometric projections and views

CO-PO ARTICULATION MATRIX

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

LIST OF EXERCISES:

1. Introduction to CAD package: Settings, draw, modify tools, dimensioning and documentation
2. Construction of Conic Sections by General method
3. Orthographic projection: Principles, conventions, Projection of points
4. Projection of straight lines: Simple position, inclined to one plane
5. Projection of straight lines inclined to both the planes (without traces and mid-point)
6. Projection of planes: Perpendicular planes
7. Projection of planes: Oblique planes
8. Projection of solids: Simple position
9. Projection of solids: Inclined to one plane
10. Sections of solids: Prism, pyramid in simple position
11. Sections of solids: Cone and cylinder in simple position
12. Isometric projections and views
13. Conversion of isometric views to orthographic projections and vice-versa.

TEXT BOOKS:

1. N.D.Bhatt, “Elementary Engineering Drawing”, Charotar Publishers, 2012.
2. K.Venugopal, “Engineering Drawing and Graphics + AutoCAD”, New Age International Pvt.Ltd, 2011.
3. Basanth Agrawal and C M Agrawal, “Engineering Drawing”, 2/e, McGraw-Hill Education (India) Pvt. Ltd.

SUGGESTED READING:

1. Shaw M.B and Rana B.C., “Engineering Drawing”, 2/e, Pearson, 2009.
2. K.L. Narayana and P.K. Kannaiah, “Text Book of Engineering Drawing”, Scitech Publications, 2011.

22MEC38

DIGITAL FABRICATION LAB

Instruction	3P Hours per week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1.5

COURSE OBJECTIVES: The objectives of this course are to:

1. Give a feel of Engineering Practices & develop holistic understanding of various Engineering materials and Manufacturing processes.
2. Develop skills of manufacturing, safety, precision, quality, intelligent effort, optimization positive &team work attitude to get things right the first time.
3. Provide basic knowledge of Steel, Plastic, Composite and other materials for suitable applications.
4. Study of Principle and hands on practice on techniques of fabrication, welding, casting, manufacturing, metrology, and allied skills.
5. Advance important hard & pertinent soft skills, productivity, create skilled manpower which is cognizant of industrial workshop components and processes and can communicate their work in a technical, clear and effective way.

COURSE OUTCOMES: After completion of course, students would be able to:

1. Understand safety measures to be followed in workshop to avoid accidents.
2. Identify various tools used in carpentry, house wiring and plumbing.
3. Make a given model by using workshop trades like carpentry, plumbing, House wiring and 3d modeling using solid works software for Additive Manufacturing.
4. Perform pre-processing operations on STL files for 3D printing, also understand reverse engineering process.
5. Conceptualize and produce simple device/mechanism of their choice.

CO-PO-PSO Correlation Matrix

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

List of exercises:
Group-1

1. To make a lap joint on the given wooden piece according to the given dimensions.
2. To make a dove tail-joint on the given wooden piece according to the given dimensions.
3.
    a. Wiring of one light point controlled by one single pole switch, a three pin socket controlled by a single pole switch
    b. Wiring of two light points connected in series and controlled by single pole switch. Verify the above circuit with different bulbs. Wiring of two light points connected in parallel from two single pole switches and a three pin socket
4. Stair case wiring-wiring of one light point controlled from two different places independently using two 2- way switches.
5. To make external threads for GI pipes using die and connect the GI pipes as per the given diagram using taps, couplings & bends.
6.
    a. A. To connect the GI pipes as per the given diagram using, couplings, unions, reducer & bends.
    b. To connect the GI pipes as per the given diagram using shower, tap & valves and Demonstrate by giving water connection

Group- 2

1. To Study the method of Additive Manufacturing process using a 3D printer
2. To create a 3D CAD model of a door bracket using a modeling software
3. To Print a door bracket using an extruder type 3D Printer.
4. To create a 3D CAD model by reverse Engineering
5. To Design an innovative component using the CAD software
6. To Print the selected innovative component by the students using a 3D printer

TEXT BOOKS:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., Elements of Workshop Technology, Vol. I, 2008 and Vol. II, Media promoters and publishers private limited, Mumbai, 2010.
2. Kalpakjian S. And Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
3. Sachidanand Jha, 3D PRINTING PROJECTS: 200 3D Practice Drawings For 3D Printing On Your 3D Printer, June 7, 2019.

SUGGESTED READING:

1. Gowri P. Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Oliver Bothmann , 3D Printers: A Beginner's Guide , January 1, 2015

20EC C15

COMPUTER ARCHITECTURE AND MICROPROCESSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Basic knowledge on digital system design

Course Objectives: This course aims to:

1. Study and understand the principles of computer system
2. Understand the design of computer system
3. Explore the architecture and instruction set of the microprocessors

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

1. Apply fixed and floating-point arithmetic algorithms.
2. Understand how the computer works.
3. Classify different organizations of CPU and I/O.
4. Compare various memories and memory access techniques.
5. Understand the architecture and instruction set of a microprocessor.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	-	-	-	-	-	-	-	2	2	1
CO2	2	1	3	1	-	-	-	-	-	-	-	2	3	2	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-	3	2	-
CO4	2	2	2	2	2	-	-	-	-	-	-	1	3	2	-
CO5	3	1	2	2	2	-	-	-	-	-	-	1	3	3	-

UNIT-I

Data representation and Computer Arithmetic: Basic structure of computers, Functional units, Fixed point representation of numbers, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non-restoring algorithms, Floating-point representation with IEEE standards.

UNIT-II

Basic Computer Organization and Design: Instruction codes, Stored program organization, Computer registers and computer instructions, Timing and control, hardwired and microprogrammed control unit, Instruction cycle, Program interrupt, Interrupt cycle, Micro programmed Control organization, Address sequencing, Micro instruction format.

UNIT-III

Central Processing Unit: General register organization, Stack organization, Instruction formats, Addressing modes, Data transfer and manipulation, Program control, CISC and RISC: features and comparison, Instruction Pipeline.

Input-Output Organization: Peripheral devices, I/O interface: I/O Bus and interface modules, isolated versus memory-mapped I/O. Modes of Transfer: Programmed I/O, DMA and Interrupt initiated I/O. Priority interrupt: Daisy chaining, Parallel Priority interrupt

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UNIT-IV

Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory, Cache memory, mapping functions: direct, associate and set associate, Virtual memory: address mapping using pages, Memory management.

UNIT-V

8086 Microprocessor: Evolution of microprocessors, 8086 Microprocessor**:** Internal architecture, flag register, Signal description under minimum and maximum mode of operation, register organization, Addressing modes. Overview of Instruction set. Introduction to the advanced microprocessors (x86): Salient features, real and protected modes. Evolution of Pentium Processors.

Text Books:

1. Moris Mano M., "Computer System Architecture", 3/e, Pearson Education, 2005.
2. Hayes J.P, "Computer Architecture and Organization", 3/e, Mcgraw Hill, 2012.
3. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro, Pentium II, III, IV", 8/e Pearson Education, 2006.

Suggested Reading:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization" 5/e McGraw Hill, 2011.
2. Ray A.K. and Bhurchandi, K.M., "Advanced Microprocessor and peripherals", 2/e TMH 2007.
3. Douglas V Hall, SSSP Rao, "Microprocessors and Its Interfacing" (SIE), 3/e, Tata McGraw-Hill Education Pvt. Ltd, 2012.

20EC C16

DIGITAL COMMUNICATION

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Fundamentals of probability theory and analog communication systems are required.

Course Objectives: This course aims to:

1. Make the student learn the different techniques involved in the digital transmission of analog signals.
2. Give the student an understanding of the various concepts of information theory, source coding, and channel coding schemes.
3. Enable the student to interpret the performance of digital modulation schemes and various Spread spectrum modulation schemes.

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

1. Understand the concept of pulse digital modulation schemes and compare their performance.
2. Interpret the concept of information theory and apply source coding schemes.
3. Demonstrate various error control schemes and develop the encoding and decoding techniques to detect and correct the errors.
4. Analyze different digital modulation schemes and can compute the bit error performance.
5. Identify and apply spread spectrum modulation techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	-	1	-	-	2	-	3	3	2	-
CO2	3	3	1	1	-	-	1	-	-	2	-	3	3	2	-
CO3	3	3	3	2	-	2	1	-	-	2	-	3	3	2	2
CO4	3	3	1	1	-	1	1	-	-	2	-	3	3	2	1
CO5	3	3	1	2	-	2	2	-	-	2	-	3	3	2	1

UNIT-I

Digital Transmission of Analog Signals: Elements of a digital communication system, Uniform quantization, PCM system, Bandwidth requirement of PCM system, Noise in PCM Systems, Non- uniform quantization, TDM-PCM system. Differential quantization, Differential PCM system, Delta Modulation, Noise in DM system, ADM. Comparison of PCM, DPCM, DM and DM schemes.

UNIT-II

Information Theory: Uncertainty, Information and Entropy, Source coding: Source coding theorem, Shannon – Fano algorithm and Huffman coding. Discrete memory-less channels, Types of channels, cascaded channels, mutual information, Channel capacity, Information rate and Information capacity.

UNIT-III

Error Control Coding: Need for error control coding, Types of transmission errors. Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, minimum distance of a block code, error detecting capabilities and error correcting, Hamming codes, Standard array and syndrome decoding. Binary cyclic codes (BCC): description of cyclic codes, encoding, decoding and error correction of cyclic codes using shift registers, Convolution codes: description, encoding, decoding: Exhaustive search method and sequential decoding.

UNIT-IV

Digital Carrier Modulation Schemes: Optimum receiver for Binary Digital Modulation Schemes, Binary ASK, PSK, DPSK, FSK signaling schemes and their error probabilities. Introduction to MSK, Comparison of Digital Modulation Schemes. Introduction to M-ary Signaling Schemes: QPSK, Synchronization methods.

UNIT–V

Spread-Spectrum Modulation: Need for spreading a code, generation and properties of PN sequence. Direct Sequence Spread Spectrum, Frequency Hopping spread spectrum systems and their applications. Acquisition and Tracking in DSSS and FHSS Systems.

Text Books:

1. Sam Shanmugham K., "Digital and Analog Communication Systems", Wiley, 2012.
2. Simon Haykin, "Communication Systems", 4/e, Wiley India, 2011.
3. Herbert Taub, Donald L. Shilling & Goutam Saha, "Principles of Communication Systems", 4/e, Tata McGraw-Hill Education 2013.

Suggested Reading:

1. John Proakis, Massoud Salehi, "Digital Communications", 5/e, McGraw Hill Higher Education, 2007.
2. R.P. Singh, S.D. Sapre, "Communication Systems", 2/e, Tata McGraw Hill Education, 2008.

20EC C17

DIGITAL SIGNAL PROCESSING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Concepts of Signals, Systems and analog filter design.

Course Objectives: This course aims to:

1. Know Discrete-time signals in the frequency domain using DFT and FFT.
2. Design digital IIR and FIR filters for the given specifications.
3. Introduce the basics of Multi-rate digital signal processing, Digital signal processor and its applications

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

1. Apply the concept of DFT and FFT for signal processing applications.
2. Implementation of IIR filters for the given specifications.
3. Design FIR filters for the given specifications.
4. Interpret the concepts of Multi-rate digital signal processing and its applications.
5. Understand the architecture features of TMS320C67XX processor.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	3	3	2	3	2	-	-	3	2	-	3	3	3	3
CO2	3	3	3	2	3	2	-	-	3	2	-	3	3	3	3
CO3	3	3	3	2	3	2	-	-	3	2	-	3	3	3	3
CO4	3	3	3	2	3	2	-	-	3	2	-	3	3	3	3
CO5	3	3	3	2	3	2	-	-	3	2	-	3	3	3	3

UNIT-I

Discrete Fourier Transform: Introduction, Discrete Fourier Transform (DFT), Properties of DFT, Efficient computation of DFT-Fast Fourier Transform (FFT) algorithms: Radix-2 FFT algorithms – Decimation in Time, Decimation in Frequency algorithms, Inplace computation, Bit reversal algorithm, Linear filtering using FFT algorithm.

UNIT-II

IIR Filter Design: Butterworth and Chebyshev approximation, IIR digital filter design techniques- Impulse Invariant transformation, Bilinear transform techniques, Digital Butterworth and Chebyshev filters, Spectral transformation techniques. Comparison between FIR and IIR filters.

UNIT-III

FIR Filter Design: Linear phase FIR filters –Introduction, types, magnitude and phase responses of linear phase FIR filters, Windowing technique for design of FIR filters – Rectangular, Bartlet, Hamming, Blackman, and Kaiser Windows. Realization of IIR filters-Direct form-I and II, Realization of FIR filters-Direct form, linear phase, Finite word length effects.

UNIT- IV

Multirate Digital Signal Processing: Introduction -Decimation by a Factor -D, Interpolation by a Factor -I, Sampling Rate Conversion by a Rational Factor -I/D, Nobel identities, design of multistage decimator, Applications of Multirate Signal Processing: Narrowband filters, subband coding of speech signal.

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UNIT-V

DSP Processors: Introduction, Difference between DSP and General Purpose Processor architectures, need for DSP processors. TMS320C67XX DSP processor: architecture, functional units, pipelining, registers, linear and circular addressing modes, instruction set.

Text Books:

1. John G. Proakis & Dimtris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Application", PHI, 4/e, 2012.
2. Sanjit K Mitra, "Digital Signal Processing, A computer based approach", TMH, 3/e, 2011.
3. Rulph Chassaing, "Digital Signal Processing and Applications with the C6713 and C6416 DSK", John wiley & sons, 2005.

Suggested Reading:

1. K. Deergha Rao & MNS swamy, "Digital Signal Processing: Theory and Practice", Springer, 2018
2. Avtar Singh & S. Srinivasan, "Digital Signal Processing Implementation using DSP microprocessors", Thomson Brooks, 2/e, 2004.

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20EC C18

LINEAR AND DIGITAL INTEGRATED CIRCUITS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge about Analog electronic circuits.

Course Objectives: This course aims to:

1. Impart the concepts of Op-Amp, 555 Timers, IC regulator, data converter and its characteristics.
2. Illustrate the linear and nonlinear applications of operational amplifier.
3. Design combinational and sequential circuits with IC, memories and PLD.

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

1. Understand the basic construction, characteristics and parameters of Op-Amp.
2. Analyze the linear and nonlinear applications of Op-Amp.
3. Explain the concepts of IC555 timer, IC723 regulator, memories and PLD.
4. Classify and describe the characteristics of different logic families
5. Design logic functions of Combinational and Sequential circuits with ICs.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	1	-	-	-	-	-	-	2	2	1	-
CO2	2	3	3	3	2	2	-	1	-	-	-	3	3	3	2
CO3	2	2	2	2	2	-	-	1	-	-	-	2	2	1	1
CO4	1	1	2	2	2	-	-	-	-	-	-	2	2	1	1
CO5	2	2	3	3	2	2	-	1	-	-	-	3	3	3	1

UNIT – I

Operational Amplifier: Op-Amp block diagram, ideal Op-Amp Characteristics, Inverting and Non-inverting amplifiers with ideal and non-ideal Op-amps, Voltage Follower, Op-Amp parameters: Input offset voltage, Output offset voltage, input offset and bias currents, Slew rate, CMRR and PSRR.

UNIT – II

Op-Amp Applications: Summing Amplifier, Difference Amplifier, ideal and practical Integrator and differentiator. Sample and hold circuit, Comparator, Schmitt Trigger with and without reference voltage, Triangular waveform generator.

UNIT – III

555 Timer: Functional diagram. Modes of operation: Monostable, Astable multivibrators.
Voltage Regulator: IC7805, Analysis and design of regulators using IC 723.
Data Converters: Specifications, DAC- Weighted Resistor, R-2R Ladder, ADC-Parallel Comparator, Successive Approximation and Dual Slope.

UNIT – IV

Logic Families: Digital IC characteristics. TTL logic family, TTL series and TTL output configurations: open collector, Totem pole, Tri state logic. MOS logic family, CMOS logic family and its series characteristics, CMOS transmission gate, CMOS open drain and high impedance outputs. Comparison of TTL and CMOS logic families.

UNIT – V

Combinational and Sequential Circuits: Design of logic functions/circuits with: Decoder, Multiplexer, Adder: Serial adder, parallel adder and BCD adder, counters: asynchronous counter (7493/74293) and synchronous counter (74163/74193)

Semiconductor Memories: Memory Terminology, ROM, RAM types, Architectures, operation, Expanding word size and capacity, Introduction to PLD's: PAL and PLA, Programming with PLDs, Introduction to CPLD&FPGA and it's architectures.

Text Books:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4/e, PHI, 2015.
2. Ronald J. Tocci, Neal S. Widmer & Gregory L. Moss, "Digital Systems: Principles and Applications", PHI, 12/e, 2016..

Suggested Reading:

1. K.R. Botkar, "Integrated Circuits", 10/e, Khanna Publishers, 2010.
2. Roy Chowdhury D, Jain S.B, "Linear Integrated Circuits",4/e, New Age International Publishers, 2018.
3. Jain R.P., "Modern Digital Electronics", 4/e, TMH, 2011.
4. Charles H Roth and Larry L Kinney, "Fundamentals of Logic Design" 7th edition, Cengage Publication, 2014.
5. David A. Bell, 'Operational Amplifier and Linear ICs', third edition, Oxford university press, 2013.

20MB C01

ENGINEERING ECONOMICS AND ACCOUNTANCY

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Concepts related to business, economics and accountancy are required.

Course Objectives: This course aims to:

1. To demonstrate the importance of Managerial Economics in Decision Making.
2. To explain the concept of Accountancy and provide basic knowledge on preparation of Final accounts.
3. To understand the importance of Project Evaluation in achieving a firm's Objective.

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

1. Apply fundamental knowledge of Managerial Economics concepts and tools.
2. Analyze various aspects of Demand Analysis, Supply and Demand Forecasting.
3. Understand Production and Cost relationships to make best use of resources available.
4. Apply Accountancy Concepts and Conventions and preparation of Final Accounts.
5. Evaluate Capital and Capital Budgeting decision based on any technique

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	3	1	1	1	1	1	1	1	-	-	-	-	-
CO2	2	2	2	2	-	1	1	1	-	1	-	1	-	-	-
CO3	1	2	1	2	2	-	2	1	-	1	-	-	-	-	-
CO4	2	2	1	2	2	1	1	3	-	1	-	-	-	-	-
CO5	1	3	1	2	1	1	2	-	-	1	2	1	-	-	-

Unit-I

Introduction to Managerial Economics: Introduction to Economics and its evolution - Managerial Economics - its Nature and Scope, Importance; Relationship with other Subjects. Its usefulness to Engineers; Basic concepts of Managerial economics - Incremental, Time perspective, Discounting Principle, Opportunity Cost, Equimarginal Principle, Contribution, Negotiation Principle.

Unit-II

Demand and Supply Analysis: Demand Analysis - Concept of Demand, Determinants, Law of demand - Assumptions and Exceptions; Elasticity of demand - Price, Income and Cross elasticity - simple numerical problems; Concept of Supply - Determinants of Supply, Law of Supply; Demand Forecasting - Methods.

Unit-III

Production and Cost Analysis: Theory of Production - Production function - Isoquants and Isocosts, MRTS, Input-Output Relations; Laws of returns; Internal and External Economies of Scale. Cost Analysis: Cost concepts – Types of Costs, Cost-Output Relationship – Short Run and Long Run; Market structures – Types of Competition, Features, Price Output Determination under Perfect Competition, Monopoly and Monopolistic Competition; Break-even Analysis – Concepts, Assumptions, Limitations, Numerical problems.

Unit-IV

Accountancy: Book-keeping, Principles and Significance of Double Entry Book Keeping, Accounting Concepts and Conventions, Accounting Cycle, Journalization, Subsidiary books, Ledger accounts, Trial Balance concept and preparation of Final Accounts with simple adjustments. Ratio Analysis.

Unit-V

Capital and Capital Budgeting: Capital and its Significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Capital Budgeting, Methods: Traditional and Discounted Cash Flow Methods - Numerical problems.

Text Books:

1. Mehta P.L., "Managerial Economics: Analysis, Problems and Cases", Sultan Chand & Son's Educational publishers, 2016.
2. Maheswari S.N. "Introduction to Accountancy", Vikas Publishing House, 11th Edition, 2013.

Suggested Reading:

1. Panday I.M. "Financial Management", 11th edition, Vikas Publishing House, 2015.
2. Varshney and K L Maheswari, Managerial Economics, Sultan Chand, 2014.
3. M. Kasi Reddy and S. Saraswathi, Managerial Economics and Financial Accounting, Prentice Hall of India Pvt Ltd, 2007.
4. A. R. Aryasri, Managerial Economics and Financial Analysis, McGraw-Hill, 2013.

20EC E04

EMBEDDED C PROGRAMMING

(Professional Elective-I)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Programming in 'C' Language

Course Objectives: This course aims to:

1. Describe the developments of embedded C programming
2. Interfacing of various sensors along with displays using Embedded 'C'
3. Develop the various applications using embedded development board

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

1. Analyze the various functions used in embedded C programming
2. Understand the evaluation of Arduino family and its development board details
3. Interface the sensors and various i/o devices to embedded development board
4. Apply the concepts of IoT to embedded development board
5. Demonstrate and design embedded C based applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	2	1	2	-	-	-	-	-	-	1	-	3	2
CO3	2	2	3	2	2	-	-	-	-	-	-	-	3	2	2
CO4	2	1	2	2	3	-	-	-	-	-	-	2	3	2	3
CO5	2	2	3	3	2	-	-	-	-	-	-	2	3	2	2

UNIT-I

Introduction to Embedded C: Overview, Data types: variables and constants, Operators, Control Statements, Arrays and Functions. i/o Functions: Pins Configured as input, Pins Configured as output, pinMode function, digitalWrite function, analog Read function, time delay functions. Simple programming in 'C'

UNIT-II

Introduction to Arduino: Origin of Arduino, familiarizing with Arduino family Introduction to Arduino UNO: Pin configuration and architecture, power connections, concept of digital and analog ports, Arduino clones and variants , installation of Arduino IDE, uploading of the program.

UNIT-III

Interfacing with Displays and Sensors: Working with Serial Monitor, Line graph via serial monitor, LED interfacing, 8 bit LCD interfacing to Arduino, Fixed one line static message display, Running message display,. Interfacing-humidity sensor, temperature sensor, gas detection sensor, PIR Sensor, Ultrasonic Sensor.

UNIT-IV

Internet of Things Programming: Communicating with web servers: HTTP, HTML, Arduino uno as a web server, Web controllers using Arduino, calling web services, Arduino uno and IFTTT, Introduction to NodeMCU and its web services

UNIT-V

Applications/Case Study: Testing the Arduino board, problems with IDE, debugging techniques, Case studies related on agriculture, medical domains using Ardunio, Applications on consumer electronics, automotive and security using Arduino development board

Text Books:

1. Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition, 2016
2. Massimo Banzi, "Getting Started with Arduino: The Open Source", Shroff Publishers & Distributors Pvt Ltd, 2014
3. Michael J. Pont, "Embedded C", 2nd Edition, Pearson Education, 2008

Suggested Reading:

1. Margolis, "Arduino Cookbook", Shroff/O'Reilly Publication, 2nd Edition 2012

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20EC E06

PRINCIPLES AND APPLICATIONS OF AI

(Professional Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of probability, Linear Algebra, Data Structure and programming.

Course Objectives: This course aims to:

1. Exposure to the foundation of Artificial Intelligence.
2. Familiarize the applications of Artificial Intelligence in Industry
3. Inculcate the concepts of Neural Networks and Pattern Recognition

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

1. Understand the basics of AI and intelligent agents.
2. Apply Expert Systems to solve real time problems
3. Understand knowledge representation methods.
4. Build algorithms using neural network techniques for various applications
5. Solve the various classification problems like object recognition

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	1	1	-	-	-	-	1	3	-	-
CO2	3	3	3	2	2	3	2	1	2	-	1	2	3	1	-
CO3	3	3	-	3	1	1	1	-	-	-	-	1	3	-	-
CO4	3	3	3	2	2	1	1	-	1	-	-	1	3	1	-
CO5	3	3	3	3	1	3	2	1	2	-	-	1	3	2	-

UNIT-I

Introduction to AI and Intelligent Agents: Concept of AI, current status of AI, Agents, Good Behavior: Environment, problem formulation. The structure of agents. Basic concepts of Search Algorithms: Uninformed depth first search, breadth first search, uniform cost search, depth limited search, iterative deepening search and informed search techniques like greedy best first search and A* algorithm, concepts of admissibility.

UNIT-II

Knowledge representation: Bayesian network representation, Construction and inference. Hidden Markov Model.Approaches to knowledge representation, knowledge representation using the semantic network, extended semantic networks for Knowledge representation, knowledge representation using frames.

UNIT-III

Expert system and applications: Introduction phases in building expert systems, expert system versus traditional systems, Rule-based expert systems, blackboard systems truth maintenance systems and application of expert systems.

UNIT-IV

Neural Networks: What is a neural network, the human brain, models of a neuron, neural networks as a directed graph, feedback and network architectures. Learning processes and learning tasks.

UNIT-V

Applications and tools of Artificial Intelligence: Pre-processing, feature extraction and time series prediction. Principle Component Analysis.

Statistical Pattern Recognition: Object recognition, Classification and regression. Application of AI in speech, Image processing and IoT, AI applications in biometric and face recognition. Introduction AI & Deep Learning with TensorFlow, Case Studies – AI in Finance and Agriculture.

Text Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence—A Modern Approach", 3rd Edition, Prentice-Hall Series, 2010.
2. Christopher M. Bishop, Clareddon, "Neural networks for pattern Recognition", Oxford, 1995.
3. Simon Haykin, "Neural networks and learning Machines", 3rd Edition, Pearson- Prentice Hall, 2009.
4. M. Narsimhamurty and V. Susheela Devi, "Pattern Recognition- An Algorithmic Approach", Springer Universities Press, 2011
5. B. Yegnanarayana, "Artificial Neural Networks", PHI, 2005.

Suggested Books:

1. Elaine Rich, Kevin Knight and Shivashankar B Nair, "Artificial Intelligence", Tata McGraw Hill Education Pvt. Ltd., 2010.
2. Flasiński, Marius, "Introduction to Artificial Intelligence", Springer International Publisher, 2016.

20EC E08

Mobile Cellular Communication

(Professional Elective-II)

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: A course on digital communications is required.

Course Objectives: This course aims to:

1. To familiarize the concepts related to cellular communication and its capacity.
2. To teach students the fundamentals of propagation models and multipath fading.
3. To describe diversity schemes as applied in mobile communication and understand latest Mobile technologies

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

1. Relate the cellular concepts like frequency reuse, hand off, coverage and capacity.
2. Analyse the mobile radio propagation with large scale and small scale fading.
3. Select the suitable diversity technique to combat the multipath fading effects.
4. Compare the mobile radio standards.
5. Examine the advance wireless standards.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	2	-	-	-	-	1	3	2	2
CO2	3	2	3	3	2	-	1	-	-	-	-	1	3	2	2
CO3	2	2	2	2	3	-	2	-	-	-	-	1	3	2	2
CO4	2	2	2	3	2	2	1	-	-	2	-	2	3	2	2
CO5	1	1	2	3	2	2	1	-	-	1	-	1	3	2	2

UNIT – I

Cellular concepts: Frequency reuse, Channel Assignment strategies, Hand off strategies. Interference and System capacity, improving coverage and capacity in cellular systems.

UNIT – II

MOBILE RADIO PROPAGATION : Large Scale Fading - Free space propagation model, Three basic propagation mechanisms, Reflection, Ground Reflection(Two-Ray)Model, Diffraction, Scattering, Practical link budget using path loss models. Small Scale Fading : Multipath Propagation, Types of small scale fading, Parameters of Mobile Multipath channels, Fading effects due to multipath time delay Spread and Doppler spread.

UNIT – III

Diversity Techniques: Diversity – Types of diversity – Diversity combining techniques: Selection, Feedback, Maximal Ratio Combining and Equal Gain Combining – Rake receiver

FDMA, TDMA, CDMA, OFDM, SDMA, Comparison of Multiple Access Techniques.

UNIT - IV

Mobile Radio standards: AMPS,2G Architecture such as GSM and CDMA, GSM system overview: GSM system architecture, GSM radio subsystem, GSM channel types, Frame structure for GSM, Signal processing in GSM, 2.5G – GPRS and EDGE- features. Concept of UWB

UNIT - V

Advance Wireless standards: Need for 3G and 4G technologies, 3G standard: UMTS - Introduction to LTE, IS-95/CDMA one, CDMA-2000.4G-features and architecture, 4G-LTE, 4.5 G and 5G.

Text books:

1. Theodore S. Rappaport - Wireless Communications Principles and Practice, 2nd Edition, Pearson Education, 2003.
2. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, First Edition, 2005.
3. Andreas F.MOlisch - Wireless Communications John Wiley, 2nd Edition, 2006.

Suggested Reading:

1. W.C.Y. Lee - Mobile Cellular Communications, 2nd Edition, MC Graw Hill, 1995.
2. Modern Wireless Communications-Simon Haykin, Michael Moher, Pearson Education, 2005.
3. Wireless Communications and Networking, Vijay Garg, Elsevier Publications, 2007.

20EC E10

SENSORS AND ACTUATORS

(Professional Elective-II)

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Basic electronics, Measurements and Instruments

Course Objectives: This course aims to:

1. To expose the students to many varieties of transducers, measuring instruments, their Operating principles and construction.
2. Understand the concept sensor and actuator systems for practical applications
3. To provide an idea of strengths and weaknesses of the various types of sensors and actuators.

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

1. Understand the fundamental and applications of several different types of sensors and actuators.
2. Evaluate and perform accurate measurements for any engineering system with clear idea of the potential errors.
3. Understand the working principles of various transducers.
4. Select an appropriate transducer for given application.
5. How to develop a sensor and actuator systems for practical applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	-	2	2	-	1	1	-	2	3	1	1
CO2	3	3	2	1	-	-	1	1	1	1	-	2	3	2	1
CO3	3	3	2	1	-	2	2	-	1	1	-	2	3	1	1
CO4	3	3	2	1	-	-	2	-	1	1	-	2	3	1	1
CO5	3	3	2	1	-	2	1	-	1	1	-	2	3	2	2

UNIT-I

SENSORS: Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Strain Gauges, Resistance thermometer, Thermistor, Resistance Hygrometer, Photo-resistive sensor.

Electronic measurement: Moving coil and moving iron meters.

UNIT-II

INDUCTIVE & CAPACITIVE TRANSDUCER: Transducer principles, active and passive transducers

Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer.

Capacitive transducers: - Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications: - capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT-III

ACTUATORS: Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.

UNIT-IV

MICRO SENSORS AND MICRO ACTUATORS:

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

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

UNIT-V

SENSOR MATERIALS AND PROCESSING TECHNIQUES: Materials for sensors: Silicon, Plastics, Metals, Ceramics, Glasses, Nano Materials. Processing Techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining and LIGA process.

Text Books:

1. D. Patranabis, “Sensors and Transducers”, Prentice Hall India Pvt., 2nd Ed, 2021.
2. Clarence W. De Silva, “Sensors and Actuators Engineering System Instrumentation”, Taylor & Francis Ltd, 2nd Ed, 2015.

Suggested Readings:

1. Jacob Fraden, “Hand Book of Modern Sensors: Physics, Designs and Application” 4Ed, Springer, 2010.
2. Jonathan Wolpaw and Elizabeth Winter Wolpaw, “Brain-Computer Interfaces: Principles and Practice”, Oxford University Press, 2012.
3. D. V. S. Murty, “Transducers and Instrumentation”, Prentice Hall India Pvt., Limited, 2008.

20EC E11

DRONES AND APPLICATIONS

(Professional Elective-II)

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Knowledge of basic concepts of signals, control systems and microprocessors is required.

Course Objectives: This course aims to:

1. To understand Flight dynamics and construction of Drones
2. To assemble and Control the operations of Drones
3. To design Quadcopter and Implement them for real world applications

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

1. Apply the concept of Flight dynamics for building Drone
2. Assemble and Program the Drone
3. Perform Testing and Control operations on the Drone
4. Apply control mechanism to track and control Parallax ELEV-8 Quadcopter Build.
5. Use of Drone for real-world applications

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	3	2	2	2	-	-	-	-	-	-	3	3	1
CO2	3	-	1	1	2	2	-	-	-	-	-	-	3	2	3
CO3	2	-	3	2	3	3	-	-	-	-	-	-	3	3	2
CO4	2	-	2	3	2	3	-	-	-	-	-	-	2	3	2
CO5	1	-	1		2	2	-	-	-	-	-	-	3	3	1

UNIT I

FLIGHT DYNAMICS OF AERIAL VEHICLES:

Types of current generation of drones based on their method of propulsion, Drone design and fabrication: Classifications of the UAV, Overview of the main drone parts, assembling a drone the energy sources, Level of autonomy. UAV, RPA, Quad copters, Basic Components and Categories, Principles of Flight, Flight Maneuvers Airframes, creating a Frame: Materials, Different Frame Shapes, Building Airframes, Flight dynamics

UNIT II

HARDWARE ANATOMY OF DRONES

Power Train, Propellers, Motors, Total Lift, Electronic Speed Controllers, Flight Battery, Radio transmitter and receiver, Flight Controller, GPS, Compass, Camera Assembling for Quad copter, Connectors, Mounting of Propellers and Powering up. Flight modes Wi-Fi connection, Concept of operation for drone Flight modes Operate a small drone in a controlled environment Drone controls Flight operations management tool.

UNIT III

TESTING AND MAINTENANCE OF DRONES

Key Flight Safety Rules, Preflight Checklist and Flight Log Information, Flight Instructions, Repair and Maintenance: Crash analysis, Common issues, Voltage testing. The safety risks Guidelines to fly safely Specific aviation regulation in the European Union European system of standardization.

UNIT IV

PARALLAX ELEV-8 QUADCOPTER:

Parallax Open Source Project,- Building the Elev-8 Quadcopter, Programming the Parallax Propeller Chip, Propulsors, Radio Controlled Systems and Telemetry, Servo Control Systems, Tracking and Performance Checks.

UNIT V

REAL WORLD APPLICATIONS AND CASE STUDIES:

Beneficial Drones, Aerial Photography, Mapping and Surveying, Precision Agriculture, Search and Rescue, Infrastructure Inspection, Conservation. Case Studies: Agriculture Weed Classification, Microdrone surveillances.

Text Books:

1. Terry Kilby and Belinda Kilby, "Make: Getting Started with Drones ",Maker Media, Inc, 2016
2. Vasilis Tzivaras, "Building a Quadcopter with Arduino", Packt Publishing, 2016.
3. Donald Norris, "Build Your Own Quadcopter -Power Up Your Designs with the Parallax Elev-8" , McGraw-Hill Education, 2014

Suggested Reading:

1. Baichtal, "Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs", Que Publishing, 2016.
2. Austin, Unmanned Aircraft Systems: UAVS Design, Development and Deployment. Wiley, 2010.
3. Sebbane, Smart Autonomous Aircraft: Flight Control and Planning for UAV. CRC Press, 2015.
4. Zavrsnik, Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance. Springer, 2015

20EC E12

FUNDAMENTALS OF CLOUD COMPUTING

(Professional Elective-II)

Instruction	2 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	2

Prerequisite: Fundamental concepts of computer networking.

Course Objectives: This course aims to:

1. To impart the fundamentals and essentials of Cloud Computing.
2. Describes the cloud architecture, layers and models.
3. Introduce the concepts of resource management and security in cloud.

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

1. Understand the basic concepts of cloud computing.
2. Describe the characteristics, advantages, risks and challenges associated with cloud computing.
3. Explain and characterize various cloud service models, cloud deployment models.
4. Investigate/Interpret the security and privacy issues related to cloud computing environments.
5. Apply the concepts of cloud computing in real world scenario.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	-	1	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	1	1	-	-
CO4	3	3	1	2	-	-	-	-	-	-	-	1	-	-	-
CO5	2	3	-	1	-	-	-	-	-	-	-	2	-	-	-

UNIT-I

Cloud Computing Overview: Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing.

UNIT-II

Cloud Insights: Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability, simplicity, vendors, security, Limitations – Sensitive information - Application development-security level of third party - security benefits, Regularity issues: Government policies.

UNIT-III

Cloud Architecture- Layers and Models

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.

UNIT-IV

Resource Management and Security in Cloud: Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT-V

Case Studies: Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS), Google Cloud Platform (GCP) and Azure. GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.

Text Books:

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", 1st Edition, John Wiley and Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W, and James F. Ransome, Cloud Computing: Implementation, Management, And Security, CRC Press, 2017.
4. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, Tata McGraw- Hill , New Delhi – 2010
5. Michael Miller – Que, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", 2008

Suggested Reading:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing – A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", OReilly, 2009.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, "Cloud computing for dummies", Wiley Publishing, Inc, 2010.

20EC C19

DIGITAL COMMUNICATION LAB

Instruction	2 P Hours per Week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge about analog communication is required.

Course Objectives: This course aims to:

1. Carry out experiments on various pulse digital modulation techniques.
2. Conduct the experiment to identify errors in cyclic codes
3. Work on convolutional encoder and decoder for controlling the errors.

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

1. Demonstrate various pulse digital modulation techniques.
2. Assess different line coding techniques.
3. Detect and correct errors in cyclic codes.
4. Examine the errors in convolutional encoder and decoder.
5. Evaluate various digital carrier modulation techniques experimentally.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	3	3	1	1	2	1	2	3	3	1
CO2	3	3	3	3	2	3	2	1	1	2	1	2	3	3	2
CO3	3	3	3	3	2	3	3	2	1	2	1	3	3	3	2
CO4	3	3	3	3	1	3	3	2	1	2	1	3	3	3	2
CO5	3	3	3	3	1	3	3	2	1	2	1	3	3	3	2

List of Experiments:

1. PCM generation and detection.
2. Data formats / Line coding techniques.
3. Linear Delta Modulation and demodulation.
4. Adaptive Delta Modulation and demodulation.
5. Error detection and correction in cyclic codes.
6. Convolutional encoder and decoder.
7. ASK generation and detection.
8. FSK generation and detection.
9. BPSK generation and detection.
10. QPSK generation and detection.
11. MSK generation and detection.
12. Structured Enquiry:
    - Design N-bit PCM encoder based on the given specifications.

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13. Open ended Enquiry:

- Develop a code for different digital modulation schemes and verify through simulation.
- Design different Line coding schemes using logic Gates.

Suggested Reading:

1. A.M. Zungeru, J.M. Chuma, M. Mangwala , L.K. Ketshabetswe, “Handbook of Laboratory Experiments in Electronics and Communication Engineering”, Vol. 2, 1st Edition, Notion press, 2017.

20EC C20

DIGITAL SIGNAL PROCESSING LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: The knowledge of basics of signals, systems, linear algebra and calculus is required.

Course Objectives: This course aims to:

1. Simulation of DFT, FFT, Digital filters and multirate concepts using MATLAB.
2. Understand spectral analysis of noisy signals using MATLAB.
3. Implementation of digital filters on DSP Processor.

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

1. Illustrate linear convolution and correlation using MATLAB.
2. Design the digital filters using MATLAB.
3. Examine the performance of multirate techniques using MATLAB.
4. Experiment with decimator and interpolator on DSP processor.
5. Implement the digital filters on DSP processor.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	2	1	2	2	-	-	-	-	2	-	1	3	1	1
CO2	2	3	2	2	2	-	-	-	-	2	-	1	3	2	2
CO3	2	2	1	2	2	-	-	-	-	2	-	1	3	2	1
CO4	2	2	1	2	2	-	-	-	-	2	-	1	3	2	1
CO5	2	3	2	2	2	-	-	-	-	2	-	1	3	3	2

List of Experiments

(A) Experiments on signal processing using MATLAB.

1. To Perform basic matrix operations and Generation of test signals.
2. Compute the Linear Convolution, circular convolution and Correlation of two sequences.
3. Determine the Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT) of the given sequence.
4. Design of FIR filter using different windows
5. Design of IIR filter: Butter worth, Chebyshev type 1 and 2: LPF, HPF, BPF & BSF filter.
6. Spectral Analysis of noisy signal using Welch's method
7. Implementation of Interpolation and Decimation
8. Design of Multistage filter

(B) Experiments on DSK and CCS

1. Study of procedure to work in real- time
2. Solutions of difference equations
3. Linear Convolution
4. Implementation of FIR filter
5. Implementation of second order IIR filters
6. Decimation and Interpolation
7. Dual Tone Multi Frequency(DTMF)

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Structured enquiry: Design the best IIR band pass filter to meet the given specifications:

Pass band cut off frequencies: [500 600] Hz
Stop band cut off frequencies: [525 675] Hz
Pass band ripple: ≤ 2dB
Stop band attenuation: ≥ 60dB

Open-ended enquiry: Design a three stage multirate filter to meet the given specifications:

Pass band cut off frequency: 450 Hz
Stop band cut off frequency: 500 Hz
Pass band ripple: ≤ 3dB
Stop band attenuation: ≥ 40dB
Sampling frequency: 40 KHz
Compare with single stage filter.

Note:

1. Minimum of 6 from Part A and 4 from Part B is mandatory.
2. For Part "A", MATLAB with different toolboxes like Signal Processing, Signal Processing block set, and SIMULINK/ MATHEMATICA/ any popular software can be used.

Suggested Reading:

1. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
2. B. Venkataramani and M. Bhaskar, "Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

20EC C21

LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB

Instruction	2 P Hours per Week
Duration of SEE	3Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Analog electronic circuits.

Course Objectives: This course aims to:

1. Know and verify the concepts of 741 Op-Amp, IC555 timer, IC723 and data converters.
2. Know the various characteristics of TTL and CMOS gates and implement the circuits with Digital ICs.
3. Contrast the differences between linear and digital ICs.

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

1. Analyze the configurations, parameters of Op-Amp (IC741).
2. Demonstrate the circuits of Op-Amp for various applications.
3. Design the circuits using IC555 timer, IC723 and data converters.
4. Determine the characteristics of TTL and CMOS gates
5. Develop various combinational circuits and sequential circuits using digital ICs.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	1	-	-	1	2	2	-	2	2	2	1
CO2	2	3	3	3	1	-	-	1	2	2	-	2	3	3	1
CO3	2	3	3	3	1	-	-	1	2	2	-	2	3	3	1
CO4	2	2	2	1	1	-	-	1	2	2	-	2	2	2	1
CO5	2	3	3	3	1	-	-	1	2	2	-	2	3	3	1

Lab Experiments

Part-A: Linear IC Experiments

1. Implement Voltage Follower, Inverting and Non-Inverting Amplifiers using Op-Amp.
2. Measurement of Op-Amp parameters
3. Implement Arithmetic Circuits using Op-Amp
4. Implement Waveform generation using Op-Amp.
5. Implement Astable and Monostable multi vibrators using IC555Timer.
6. Implement Low and High Voltage Regulators using IC723.
7. Implement D to A Converter using R-2R ladder.
8. Implement A to D Converter

Part-B: Digital IC Experiments

1. Measurement of various characteristic parameters of TTL and CMOS gates.
2. Implement Logic function Implementations using Decoders.
3. Implement Logic function Implementations using Multiplexers
4. Implement Binary adder and subtractor, BCD adders using ICs.
5. Design of Synchronous, Asynchronous up/down counters.
6. Implement Shift registers and ring counter using ICs.
7. Implement the Interfacing counters with 7-segment LED display units.

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Structured enquiry: Implement a Security Monitoring System (Use only nonprogrammable ICs.)

Open ended enquiry: Design a Digital Clock structure to display minutes and seconds. (Use only non-programmable ICs.)

Suggested Reading:

1. National Semiconductor Corporation, “Linear applications”, Data book, 1986.
2. National Semiconductor Corporation, “Logic data book-Vol-II”, 1984.

20EC I02

INDUSTRIAL INTERNSHIP/ RURAL INTERNSHIP

Instruction/Demonstration/Training	3-4 Weeks/90 Hours
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	2

Prerequisite: Knowledge of Basic Sciences and Engineering Sciences/Knowledge about rural environment

Course Objectives: This course aims to:

1. Exposing the students to the industrial environment/ rural environment
2. Create awareness with the current industrial technological developments relevant to program domain
3. Provide opportunity to understand the social, economic and administrative considerations in organizations/rural areas

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

1. Understand Engineer's responsibilities and ethics
2. Use various materials, processes, products and quality control
3. Provide innovative solutions to solve real world problems
4. Acquire knowledge in technical reports writing and presentation
5. Apply technical knowledge to real world industrial/rural situations

.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	3	-	3	-	3	3	-	-	3
CO2	1	1	1	3	3	-	2	1	-	-	-	-	3	3	-
CO3	2	3	3	3	3	2	3	1	1	-	-	-	3	3	-
CO4	-	-	-	-	-	3	-	1	3	3	-	1	-	-	3
CO5	1	3	3	3	3	2	3	-	1	-	-	1	3	3	3

For implementation procedures and letter formats, annexures I and III of Internship document may be referred.
Evaluation of Internship: The industrial training/internship of the students will be evaluated in three stages:

a) Evaluation by the Industry (in the scale of 1 to 10 where 1-Unsatisfactory; 10-Excellent)

b) Evaluation by faculty Mentor on the basis of site visit(s) or periodic communication (15 marks)

c) Evaluation through seminar presentation/Viva-Voce at the Institute by the constituted committee (25 marks)

Evaluation through Seminar presentation/Viva-Voce at the institute: Students shall give a seminar before an E*xpert Committee* constituted by college (Director, HoD/Senior faculty, mentor and faculty expert from the same department) based on his/her training/internship carried out

The evaluation will be based on the following criteria:

- Quality of content presented
- Proper planning for presentation
- Effectiveness of presentation
- Depth of knowledge and skills

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- Attendance record, daily diary, departmental reports shall be analyzed along with the internship Report

Monitoring/ Surprise Visits: During the internship program, the faculty mentor makes a surprise visit to the internship site, to check the student's presence physically. If the student is found to be absent without prior intimation to the concerned industry, entire training/internship may be canceled. Students should inform through email to the faculty mentor as well as the industry supervisor at least one day prior to avail leave.

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20EC C22

MICROCONTROLLERS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Knowledge of Computer Architecture and Microprocessors.

Course Objectives: This course aims to:

1. Understand architecture features of the microcontrollers
2. Learn the programming of the microcontrollers
3. Understand interfacing of various modules with microcontrollers.

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

1. Understand the architectures of different microcontrollers to enable to design of applications using them.
2. Develop code both in assembly and in high level language for various applications of microcontrollers.
3. Analyze and develop applications by using on-chip peripherals of different microcontrollers.
4. Interface various I/O Modules with 8051 microcontrollers.
5. Apply theoretical learning to practical real time problems for automation.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	3	3	-	-	-	-	-	-	3	3	2
CO2	3	3	3	2	3	3	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	3	-	-	-	-	-	-	3	3	2
CO4	2	2	3	2	3	2	-	-	-	-	-	-	3	3	2
CO5	3	3	3	2	3	3	-	-	-	-	-	3	3	2	2

UNIT-I

8051Microcontroller: Introduction to Microcontroller, Overview of 8051 family, Internal Architecture of 8051, PSW, Pin description, I/O Ports, Memory organization and expansion. Addressing modes and Bit addressable features, 8051 Instruction set: Data transfer, Arithmetic, Logical, Program branching and bit manipulation instructions.

UNIT-II

8051 Programming: Introduction to 8051 programming development tools, basic programming using instruction set, Introduction to 8051 C Programming, SFRs, 8051 Timer Programming in Assembly and C, 8051 Serial port Programming in Assembly and C, 8051 Interrupt Programming in Assembly and C.

UNIT-III

8051 Interfacing: 8051 interfacing to external memory (RAM, ROM), 8255 PPI interfacing, LCD and Keyboard interfacing, Digital to Analog converter, Analog to Digital converter and Sensor interfacing, Relay and PWM, DC Motor interfacing, Stepper Motor interfacing

UNIT-IV

ARM: Introduction to RISC Processors, ARM Design Philosophy, ARM Processor families, Architecture- Revisions, Registers, Program status register, Pipeline, Introduction to Exceptions,

ARM Instruction set: Data processing instructions, Branch instructions, Load-Store instructions, Software interrupt instruction, Program Status Register instructions, Loading constants, and Conditional executions. Introduction to THUMB instructions: Differences between Thumb and ARM modes, Register usage.

UNIT-V

ARM 7 Microcontroller (LPC2148)**:** Salient features of LPC 2148, Pin description of 2148, Architectural Overview.

ARM 7(LPC2148) **Peripherals:** Description of General-purpose input/output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, ADC, DAC. Brief overview on I2C, SPI and Embedded application using communication protocols.

Text Books:

1. Mazidi M.A, Mazidi JG & Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Andrew N. Sloss, Domonic Symes, Chris Wright, "ARM System Developers Guide Designing and Optimizing system software", 1/e, Elsever, 2004.

Suggested Reading:

1. Ayala K.J, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International, 2007.
2. Steve Furber, "ARM System on Chip Architecture", 2/e, Pearson education, 2000.
3. Philips semiconductors, "ARM 7 (LPC 214x)user manual", 2005.
4. Lyla B. Das, "Architecture, Programming and Interfacing of Low-power Processors-ARM 7, Cortex-M", CENGAGE, 2017.

20EC C23

VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Aprior knowledge of Verilog HDL and MOS Transistor Theory.

Course Objectives: This course aims to:

1. Study the concepts of Verilog HDL, simulation and synthesis process/concepts.
2. Learn the various characteristics of MOS transistor, process steps in IC fabrication.
3. Learn the various concepts required to obtain the digital logic layout diagrams. To know various subsystem design concepts.

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

1. Model a digital design using Advanced Verilog HDL constructs.
2. Analyse the characteristic behavior of MOSFET and discuss CMOS circuit Design Process
3. Explain various process steps involved in IC fabrication.
4. Design various NMOS and CMOS based logic circuits.
5. Discuss the concepts of subsystem designs and Testing.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	2	-	-	-	-	-	2	-	-	-	2	3	1	1
CO2	2	3	-	3	-	-	-	2	-	-	-	2	3	2	1
CO3	-	-	-		-	-	-	2	-	-	-	2	3	1	1
CO4	1	3	-	2	-	-	-	2	-	-	-	2	3	3	1
CO5	-	1	-	1	-	-	-	2	-	-	-	2	3	1	1

UNIT-I

Advanced Verilog HDL: Review of behavioural modelling**.** Functions and tasks Switch level Modelling, UDP, Design of Mealy and Moore state models using Verilog, Logic Synthesis, Synthesis Design flow, Gate level Netlist.

UNIT–II

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect.

Scaling of Technology, MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams.

UNIT–III

Process steps in IC fabrication Crystal growth and wafer preparation-Czochralski process-apparatus-silicon shaping, slicing and polishing- Diffusion, Ion implantation- Annealing process- Oxidation process- Lithography-Photolithography, electron beam and x-ray lithography-Chemical vapour deposition (CVD)-epitaxial growth-reactors-metallisation and packaging.

UNIT–IV

Design of MOS inverters with different loads. Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter, D flip flop using Transmission gates.

UNIT–V

Memories:1T, 3T Dynamic RAM Cell, 6T Static RAM Cell. NOR and NAND based ROM Memory Design.

Testing: Introduction to Testing, Fault models (stuck-at 1 and stuck – at-0)-Path sensitization and D-Algorithm, Controllability, Observability. Introduction to SoC and ASIC design.

Text Books:

1. Samir Palnitkar,"Verilog HDL:A guide to Digital design and synthesis", 2/e, Pearson Education, 2008.
2. Kamran Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
3. Neil HEWeste, David Harris, Ayan Banerjee, "CMOS VLSI Design–A circuit and System Perspective", 3/e, Pearson Education,2006.
4. Parag K Lal, " Fault Tolerant and Fault Testable Hardware Design " , BS Publications, 2020
5. S.M. Sze, VLSI Technology,McGraw-Hill, 2nd Edition, 1988.

Suggested Reading:

1. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
2. John P. Uyemura, "Introduction to VLSI Circuits and systems", John Wiley & Sons, 2011.
3. Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw-Hill, 1998.

20EC E13

CPLD AND FPGA ARCHITECTURES

(Professional Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Digital logic design and digital integrated circuits.

Course Objectives: This course aims to:

1. Study various PLD, CPLDs and FPGA Architectures and its features.
2. Understand the different programming technologies, placement and routing,.
3. Study the design tools for FPGA and ASICs.

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

1. Explain the concepts of PLDs, CPLDs and FPGAs.
2. Analyze and compare the various architectures of CPLD and FPGA and its programming technologies.
3. Implement various logic functions on PLDs, CPLDs and FPGAs.
4. Understand the concepts of placement and routing and classifying ASICs.
5. Demonstrate VLSI tool flow for CPLDs and FPGAs.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	-	1	1	-	-	2	-	-	-	2	3	3	1
CO2	2	3	1	3	2	-	-	2	-	-	-	2	3	3	1
CO3	-	2	-	1	-	-	-	2	-	-	-	2	3	3	1
CO4	2	3	-	3	2	-	-	2	-	-	-	2	3	3	1
CO5	-	3	-	2	2	-	-	2	-	-	-	2	3	3	1

UNIT I

Review of Logic Design: Implementation of logic functions with multiplexers.
Programmable Logic Devices: Architectures of PROM, PLA and PAL. Implementation of MSI circuits using Programmable Logic Devices.

UNIT II

Complex Programmable Logic Devices: Introduction to CPLD Architecture of CPLD. Logic Block, I/O Block, Interconnect matrix, and features of Altera max 7000 series, AMD Mach 4 and Xilinx XC-9500 CPLD.

UNIT III

Xilinx FPGAs: Introduction to FPGA, FPGA Programming Technologies. Architecture, Logic Blocks, I/O Block, Routing Architecture and features of Xilinx XC-4000, SPARTAN-II, Virtex-II and salient features of Virtex III to VII devices.

UNIT IV

Actel and Altera FPGAs: Anti-Fuse Programmed FPGAs: Introduction, Architecture of Actel's Act1, Act2, and Act3 FPGAs. Designing of logic circuits with the ACT devices. Logic Block, I/O Block, Routing Architecture and features of Altera's Flex 10000 series FPGA.

UNIT V

Digital Design Flow: Digital design tools for FPGAs. Digital design flow for CPLDs and FPGAs. Importance of Placement and Routing, Introduction to ASICs: Semi-Custom and Full-Custom ASICs.

Text books:

1. S. Trimberger, Edr, "Field Programmable Gate Array Technology", Springer Pub., 2011.
2. Ronald J . Tocci, Neal S. Widmer, Gregory L. Moss "Digital Systems", 10/e, Pearson academic press 2011.
3. P.K.Chan& S. Mourad, "Digital Design Using Field Programmable Gate Array", PHI, 1994.

Suggested Reading:

1. S. Brown, R.J.Francis, J.Rose, Z.G.Vranesic, "Field programmable gate array", BSP, 2007.
2. Altera, AMD, Actel, "Manuals Xilinx", 2015

20EC E18

CRYPTOGRAPHY AND BLOCKCHAIN TECHNOLOGY

(Professional Elective-III)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Data Structures and Algorithms, Introduction to Programming.

Course Objectives: This course aims to:

1. Provide conceptual understanding of basic concepts of cryptography.
2. Describes the Blockchain technology and its applications.
3. Introduce cryptocurrency transactions using Blockchain technology.

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

1. Comprehend the key concepts of fundamental cryptography techniques which are required for Blockchain Technology.
2. Describe the key concepts and compare various models of Blockchain Technology.
3. Understand consensus mechanism in Blockchain.
4. Acquire knowledge regarding cryptocurrency transactions and their validation.
5. Apply the concepts of Blockchain technology in real world scenario.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	2	1	-	-	-	-	-	1	2	2
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	-	1
CO3	2	2	2	1	-	-	-	-	-	-	-	-	-	-	2
CO4	3	2	2	2	1	-	-	-	-	-	-	-	-	-	2
CO5	3	2	1	1	-	2	1	-	-	-	-	-	1	2	2

UNIT-I

Overview of Cryptography: Introduction to Cryptography, History and development of cryptography; Cryptanalysis; Classical cryptosystems: shift, substitution and Vigenere ciphers; Attacks on shift, substitution and Vigenere ciphers; Designing a provably secure system, One -Time pads.

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography: RSA Algorithm, Elliptical Curve Cryptography, A basic Cryptocurrency and example.

UNIT-II

Introduction to Blockchain Technology: Introduction to client-server architecture, distributed computing and their limitations. Evolution of Blockchain and how it is changing the landscape of digitalization, Block in a Blockchain, Working principles of blockchain technology. Types of Blockchain: Public, Private and Consortium, Permissioned Model of Block chain, Public Ledgers, Smart Contracts, Transactions, Mining Mechanism, Consensus.

UNIT-III

Introduction to digital wallet and types of wallets: Desktop, mobile and Meta mask/Browser based wallets. Introduction to Bitcoin Blockchain, Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW), HashcashPoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

UNIT-IV

Bitcoin versus Ethereum, Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verifications, using smart contracts to enforce legal contracts, Introduction to Hyperledger and Truffle..

UNIT-V

Applications: Blockchain Technologies for IoT, Supply Chain Management in Agriculture using Blockchain and IoT.

Text Books:

1. Paar Christof, Pelzl Jan, "Understanding Cryptography A Textbook for Students and Practitioners", Springer, 2010.
2. Joseph J. Bambara, Paul R. Allen, “Blockchain A Practical Guide to Developing Business, Law, and Technology Solutions”, 1st Edition, Mc. Graw Hill, 2018.
3. Daniel Drescher, “Block Chain Basics”, Apress; 1st Edition, 2017.
4. Shiho Kim, Ganesh Chandra Deka, "Advanced Applications of Blockchain Technology", Springer, 2020.

Suggested Reading:

1. Imran Bashir, “Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing, 2018.
2. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Block Chain”, Packt Publishing, 2018.

20EC E19

DESIGN FOR TESTABILITY

(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of Digital System Design.

Course Objectives: This course aims to:

1. Provide an in-depth understanding of the testing and faults affecting VLSI circuits.
2. Provide knowledge on various testing methods.
3. Evaluate various test cases

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

1. Understand the concepts of testing for VLSI circuits.
2. Apply techniques to improve testability of VLSI circuits.
3. Utilize logic simulation methods such as ATPG in testing of VLSI circuits.
4. Analyze the concepts of BIST in testing of VLSI circuits.
5. Evaluate various Testing methods

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	2	-	-	-	2	3	1	1
CO2	2	2	2	-	-	-	-	2	-	-	-	2	3	`	1
CO3	1	-	-	-	-	-	-	2	-	-	-	2	3	1	1
CO4	1	2	1	-	-	-	-	2	-	-	-	2	3	1	1
CO5	1	1	1	-	-	-	-	2	-	-	-	2	3	1	1

UNIT-I

Introduction to VLSI testing: Importance of testing, Challenges in VLSI testing, Levels of abstractions in VLSI testing, Functional vs. Structural approach to testing, Complexity of the testing problem, Controllability and Observability, Generating test for a single stuck at fault in combinational logic, D-algorithm, PODEM algorithms, Test optimization and fault coverage.

UNIT–II

Design for testability (DFT): Testability analysis, Scan cell design, Scan architectures, Scan design rules, Scan design flow, Special purpose scan designs Logic and fault simulation, Fault detection, Adhoc and structured approaches to DFT, Various kinds of scan design.

UNIT–III

Test generation: Random test generation, Boolean difference, ATPG algorithms for combinational circuits, Sequential ATPG, Untestable faults, IDDQ testing The LFSRs and their use in random test generation and response compression.

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UNIT–IV

Built-in self-test (BIST): Design rules, Exhaustive testing, Pseudo-random testing, Pseudo-exhaustive testing, Output response analysis, Logic BIST architectures Test compression: Test stimulus compression,

UNIT–V

Boundary scan and core -based testing: IEEE standards for digital boundary scan, Embedded core test standards Analog and mixed signal testing, Delay testing, Physical failures, Soft errors Reliability, FPGA testing.

Text Books:

1. Parag K. Lala, An Introduction to Logic Circuit Testing, Morgan & Claypool Publishers
2. Michael L. Bushnell and Vishwani D. Agrawal, Essentials of Electronic Testing, Springer India

Suggested Reading:

1. Parag K Lal, " Fault Tolerant and Fault Testable Hardware Design " , BS Publications, 2020
2. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, Jaico Publishing House

20EC E20

SATELLITE COMMUNICATION

(Professional Elective-IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A course on digital communications is required.

Course Objectives: This course aims to:

1. To understand the orbital aspects of satellite communication.
2. To study the satellite links and earth stations.
3. To know the working principles of DBSTV and VSAT.

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

1. Demonstrate the fundamental concepts of Orbital Aspects and Orbital Mechanics
2. Identify the mechanisms for placing satellites and examine the orbital effects on satellites, launch mechanisms.
3. Compare the Multiple access techniques for satellite communications and demonstrate the satellite subsystems.
4. Design an appropriate satellite communication link for the given specifications
5. Inspect the working principle and related aspects of DBSTV and VSAT.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	3	-	1	-	-	-	-	1	3	2	-
CO2	3	2	2	2	2	-	2	-	-	-	-	1	3	2	-
CO3	2	2	2	1	3	2	-	-	-	-	-	1	3	-	-
CO4	2	2	1	3	2	2	-	-	-	-	-	1	3	3	1
CO5	2	2	2	2	2	-	-	-	-	-	-	2	3	-	-

UNIT - I

INTRODUCTION AND ORBITAL ASPECTS OF SATELLITE COMMUNICATIONS : Introduction to Satellite Communication: Brief history of satellite communications, satellite services, frequency allocations, basic communication satellite system – earth segment and satellite segment, advantages and applications of satellite communications, salient features of Indian communication satellites. Introduction to satellite orbits – LEO, MEO, HEO, Polar orbits, sun-synchronous orbits, geo-synchronous and geo-stationary orbits. **Orbital Mechanics:** Kepler's laws, describing the orbit of a satellite, locating the satellite in the orbit and with respect to earth, Keplerian elements.

UNIT – II

Look Angle Determination: sub-satellite point, elevation and azimuth angle calculations, visibility test.

Orbital Perturbations: Longitudinal changes and inclination changes

Orbital Effects on Communication System Performance

Launches and Launch Vehicles: Launch vehicles, placing satellites into geo-stationary orbit, salient features of Indian launch vehicles – PSLV and GSLV.

UNIT – III

SATELLITE SUB SYSTEMS: Introduction, attitude and orbit control system, Telemetry, tracking, command and monitoring, Power Systems, Communication Subsystems, Satellite antennas. **MULTIPLE ACCESS TECHNIQUES:** Introduction, FDMA Systems, TDMA Systems, Beam switching and satellite switched TDMA, Spread spectrum techniques (CDMA), Comparison of multiple access techniques.

UNIT - IV

SATELLITE LINK DESIGN: **Satellite Link Design:** Basic transmission theory, system noise temperature and G/T ratio – noise temperature, calculation of system noise temperature, noise figure and noise temperature, design of down link, uplink design, design for specified C/N – combining C/N and C/I values, overall $(C/N)_0$ with uplink and downlink attenuation, attenuation in rain, uplink attenuation and $(C/N)_{up}$, downlink attenuation and $(C/N)_{dl}$, satellite communication link design procedure.

UNIT - V

DBS TV: Introduction, power rating and number of transponders, frequencies and polarization, transponder capacity, home receiver outdoor unit and indoor unit.

VSAT: Overview, network architecture, modulation, coding and interference issues, brief introduction to VSAT antennas, indoor and outdoor units.

Text Books:

1. T Pratt and W Bostiain - Satellite Communications, 2nd Edition, John Wiley, 2003.
2. Dennis Roddy, Satellite communications, McGraw Hill, 4 th Edition, 2009.
3. DC Agarwal, Satellite Communications, Khanna Publishers, 2003 Robert M Gagliard, Satellite
4. Communications.

Suggested Reading:

1. M. Richharia, "Satellite Communication Systems: Design Principles", McGraw Hill, 2/e, 2003.
2. Gagliardi Robert M, "Satellite Communications", 2/e, Van Nostrand Reinhold, 1991.

20EC E22

EMBEDDED SYSTEMS

(Professional Elective - IV)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Computer Architecture, Microprocessors and Microcontrollers.

Course Objectives: This course aims to:

1. Learn about fundamentals of the embedded systems.
2. Understand the hardware and software details of the embedded systems.
3. Acquire knowledge on the serial, parallel and network communication protocols.

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

1. Understand the fundamentals of the embedded systems.
2. Analyze the hardware and software details of the embedded systems.
3. Design interfacing of the systems with other data handling / processing systems.
4. Evaluate the performance of an embedded system using various debugging tools.
5. Apply the embedded design approach for various applications.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	-	-	-	1	-	-	2	-	-	-	-	1	-	-	-
CO2	-	2	1	1	3	3	2	-	-	-	-	2	-	2	1
CO3	2	2	-	3	3	3	3	-	-	-	-	2	2	2	-
CO4	2	3	2	1	3	3	-	-	-	-	-	3	2	3	2
CO5	3	3	2	1	3	3	3	-	-	-	-	3	3	3	2

UNIT-I

Introduction to Embedded Systems: Embedded systems versus General Computing Systems, History of embedded systems, classifications, applications areas, characteristics and quality attributes of embedded systems, Design metrics and challenges in embedded system design.

UNIT-II

Embedded Hardware and Software: Processor embedded into a system, Processor selection for embedded system, embedded hardware units and devices in a system, embedded software in a system and an overview of programming languages, challenges and issues related to embedded software development.

UNIT-III

Communication Protocols: I2C, CAN, Firewire-IEEE 1394 Bus standard, advanced serial high-speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X, Internet Enabled Systems-Network protocols: Ethernet.

UNIT-IV

Embedded Software Development Process: Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system. Issues in hardware and software design and co-design.

UNIT-V

Testing, Debugging Techniques and Applications: Integration and testing of embedded hardware, testing methods, debugging techniques, Laboratory tools and target hardware debugging: Logic Analyzer, simulator, emulator and In-circuit emulator, IDE **Case Study**: Embedded Systems design for automatic vending machines and digital camera.

Text Books:

1. Raj Kamal, "Embedded Systems-Architecture, Programming and Design",3/e, McGraw Hill Education,2017.
2. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2011.

Suggested Reading:

1. Shibu K V, "Introduction to Embedded systems", 1/e McGraw Hill Education,2009.
2. David Simon, "An Embedded software primer", Pearson Education,2002

20EC E25

CMOS Data Converters

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: A prior knowledge of Analog IC Design

Course Objectives: This course aims to:

1. Familiarization of OP-AMP based circuits
2. To understand performance measures of Data converters.
3. To study different types of data converter circuits.

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

1. Understand Op-Amp based designs
2. Explain various performance measures of Data converters
3. Design and analyze mixed mode circuits such as Comparator, switched capacitor and sample & hold circuits
4. Design and analyze an A/D or D/A converter circuits.
5. Explain principles of oversampling

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	1	2	-	-	-	-	-	2	-	-	-	2	3	1	1
CO2	2	3	-	3	-	-	-	2	-	-	-	2	3	2	1
CO3	-	-	-	-	-	-	-	2	-	-	-	2	3	1	1
CO4	1	3	-	2	-	-	-	2	-	-	-	2	3	3	1
CO5	-	1	-	1	-	-	-	2	-	-	-	2	3	1	1

UNIT I

OP-Amp as comparator, Charge injection error, switched capacitor basic operation and analysis, first order filter, switched capacitor gain circuits, Sample and hold circuit-its performance

UNIT II

Introduction, Ideal data converter, Quantization, Static performance, Dynamic performance, frequency domain measures.

UNIT III

Nyquist rated DAC, Decoder based converter, binary scaled converter, thermometer coded converter, hybrid converter

UNIT IV

Successive approximation converter, algorithmic ADC, Flash converter, two-step ADC, Interpolation ADC, folding ADC, piplied ADC,Time interleaved adc

UNIT V

Oversampled converter -Oversampling with and without noise shaping, system architecture, digital decimation filter, high order modulation, band pass over sampling converter, multi bit oversampling converter, third order ADC

Text Books:

1. D.A John & Ken Martin, "Analog Integrated Circuit Design". John Wiley Publications, Reprint 2011.
2. BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata-McGraw Hill Publications,2002.

Suggested Book:

1. Philip E. Allen & Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 2002

20EC E26

5G COMMUNICATIONS

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The student must prior knowledge in Communication systems, Mobile Cellular Communications

Course Objectives: This course aims to:

1. Understand the requirements & concepts of 4G/5G.
2. Expose the architecture and radio access technologies of 5G.
3. Learn Massive MIMO concepts.

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

1. Recall the requirements and key functionalities of 4G LTEA/5G NR technology.
2. Compare various channel access technologies, modulation techniques used in 5G wireless systems.
3. Illustrate the architecture of 5G and its NextGen core network.
4. Apply the 5G concepts to D2D communications.
5. Demonstrate the concept of massive MIMO.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	3	-	3	2	2	3	-	-	-	-	-	-	3	3	1
CO2	3	-	2	1	2	3	-	-	-	-	-	-	3	3	3
CO3	3	-	3	3	3	3	-	-	-	-	-	-	3	3	2
CO4	3	-	3	3	3	3	-	-	-	-	-	-	3	3	2
CO5	1	-	1		2	2	-	-	-	-	-	-	3	3	2

UNIT I

Overview of 4G/5G Wireless Communications: Evolution of mobile technologies (1G-5G), 3GPP Releases & its key aspects,4G overview, Overview of 5G, three high level 5G usage scenarios (eMBB, URLLC, mMTC), Key capabilities & requirements, performance & efficiency indicators, 5G vs. LTE-A Comparison, 5G frequency bands, 5G Use cases.

UNIT II

5G Channel Access Techniques: Basic requirements of transmission over 5G, Modulation Techniques- generalized frequency division multiplexing (GFDM), filter bank multi-carriers (FBMC) and universal filtered multi-carrier (UFMC), Multiple Accesses Techniques –non-orthogonal multiple accesses (NOMA), Sparse Code Multiple Access (SCMA) –Comparison of multiple access methods.

UNIT III

5G Architecture: Introduction: NGMN 5G Architecture framework, Layered functionality, 3GPP 5G architecture, Non-Roaming 5G system architecture, overall RAN architecture, Functional Split Between NG-RAN and 5G Core Network.

5G NextGen core network: Modern network requirements, SDN architecture, NFV benefits and requirements, – NFV Reference Architecture.

UNIT IV

Device-to-device (D2D) communications: use cases of D2D communication in Cellular networks, D2D in 5G: research challenges, Radio resource management for mobile broadband D2D.Multi-hop D2D communications for proximity and emergency services.

UNIT V

Massive Multiple-Input Multiple-Output (MIMO) Systems: Introduction to Multi-Antenna system, Theoretical background: MIMO requirement, MIMO vs. massive MIMO, Massive MIMO benefits, single user and multi-user MIMO, capacity of MIMO for unknown CSIT, massive MIMO capacity, Massive MIMO OFDM transmitter employing digital precoding, analog beamforming and hybrid of digital precoding and analog beamforming.

Text Books:

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019. (Unit1, Unit2)
2. Suvra Sekhar Das and Ramjee Prasad, "Evolution of Air Interface Towards 5G: Radio Access Technology and Performance Analysis", Gistrup, Denmark: River Publishers series in Communication, 2018.(Unit 2)
3. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, **"**5G Mobile Communications", Springer publications-2016.(Unit 1)
4. William Stallings "5G Wireless: A Comprehensive Introduction", Pearson Education, 2021.(Unit 3)
5. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology" Cambridge University Press-2016.(Unit 4 & 5)

Suggested Reading:

1. R. S. Kshetrimayum, "Fundamentals of MIMO Wireless Communications", Cambridge University Press, UK, 2017.(Unit 5)
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.

20EC E28

ADVANCED MICROPROCESSORS AND APPLICATIONS

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Computer Architecture and Microprocessors

Course Objectives: This course aims to:

1. Describe the hardware and software enhancements of the 80x86 microprocessors as compared to the 8086.
2. Contrast the changes in memory management unit and paging unit when compared to 80386 and 80486 microprocessors.
3. Detail the improvements in the Pentium Pro when compared to the Pentium.

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

1. Understand the historic evaluation of 80286,386,486
2. Explain the basic and advance Pentium features & architecture.
3. Analyze the Memory Management mechanisms employed in advanced Microprocessors.
4. Understand the concepts related to SoC Design
5. Demonstrate and design a microprocessor based applications.

Course Articulation Matrix

UNIT-I

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	2	-	-	-	-	-	-	-	-	2	2	-
CO2	2	1	3	1	-	-	-	-	-	-	-	2	2	2	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-	2	2	-
CO4	2	2	2	2	2	-	-	-	-	-	-	1	2	2	-
CO5	3	1	2	2	2	-	-	-	-	-	-	1	2	2	2

The 80186 and 80286 Microprocessors:

80186 Architecture, Features, Pin-Out, Peripheral Control Block, Interrupt Controller, Timers, DMA Controller, Chip Selection Unit.

Introduction to 80286 Microprocessor, Hardware Features, Additional Instructions, The Virtual Memory Machine - Real and Protected Virtual Address Modes.

UNIT-II

The 80386 and 80486 Microprocessors:

Introduction to 80386 Microprocessor, Special registers, Memory Management – Descriptors and Selectors, Descriptor tables, Protected and Virtual 8086 modes, The Memory Paging Mechanism.

Introduction to 80486 Microprocessor – Basic Architecture, Memory System.

UNIT-III

The PENTIUM Microprocessors:

Introduction to the Pentium Microprocessor, Branch Prediction Logic, Cache structure, Superscalar Architecture, Special Pentium registers, Pentium Memory Management- Paging Unit, memory Management mode, New Pentium Instructions.

Introduction to the Pentium Pro Microprocessor – Internal structure, Pin connections, The Memory System, Input/Output system, Special features.

Introduction to the Pentium II, Pentium III, Pentium 4 and Core2.

UNIT-IV

System on Chip: System-on-Chip Concept, SoC Architecture, SoC Design Flow, IP based SoC Designs, Basic Concepts of Bus-Based Communication: Bus based approach and NoC based approach, Processor selection for SoC, Embedded Processors, ASIP, Product economics and implications of SoC.

UNIT-V

Applications of Microprocessors:

Microprocessor based Aluminium Smelter Control – General Process Description of an Aluminium Smelter, Sailent Issues in Design, Smelter Controller Hardware, and Control Algorithm.

Design of Microprocessor based Pattern Scanner System – Organization of the Scanner system, Description of Scanning system, Programmed mode of operation, Memory read/write system and Start-Up Procedures.

Text Books:

1. Barry B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80386, 80486, Pentium, Pentium Pro, Pentium II, Pentium III, Pentium 4, and Core2 with 64 – bit extensions Architecture, Programming, and Interfacing", 8/e Pearson Education, 2009.
2. K M Bhurchandi and A K Ray, "Advanced Microprocessor and peripherals", 3/e McGraw Hill, 2013.
3. Michael J Flinn, Wayne Luk, "Computer System Design: System-on-Chip", Wiley, 2012.

Suggested Reading:

1. Douglas V Hall, SSSP Rao, "Microprocessors and Interfacing", 3/e McGraw Hill, 2012.
2. James L Antonakos, "The Intel ® Microprocessor Family: Harware and Software Principles and Applications", First edition, CENGAGE Delmar Cengage Learning, 2006.
3. Gilmore, "Microprocessors Principles and Applications", 2/e TATA McGraw Hill, 1995.
4. Shuying Ma, Jianwei Chang et.al " Progress and Applications of Embedded System in Chip Technology" IEEE 70th Electronic Components and Technology Conference (ECTC) 03-30 June 2020, Orlando, Florida, USA DOI: 10.1109/ECTC32862.2020.00262

20EC E29

PRINCIPLES OF GNSS

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: Fundamental concepts of communication are required.

Course Objectives: This course aims to:

1. Explain the basic principle of operation of GPS, GPS ephemerides and signal structure.
2. Make the students to understand various coordinate systems and highlight the effect of various errors affecting GPS signals.
3. Make the students to appreciate the significance of other GNSS systems, principle of DGPS and augmentation systems.

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

1. Demonstrate the fundamental concepts of communications in understanding of GPS architecture, operation and signal structure.
2. Apply the principles of orbital mechanics, time references, coordinate systems and range measurements in estimating user position.
3. Examine the effect of various error sources and satellite geometry on position estimates and analyze the suitability of a given data format.
4. Compare the architecture and working of other GNSS systems and make use of GNSS systems in a variety of civilian and defense applications.
5. Relate the knowledge of DGPS techniques in understanding augmentation systems.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	1	1	2	-	1	-	2	3	1	1
CO2	3	3	2	2	1	1	1	2	-	1	-	2	3	1	-
CO3	3	3	3	3	1	1	1	2	-	1	-	2	3	1	-
CO4	2	2	2	1	-	1	1	2	-	1	-	2	3	-	-
CO5	3	2	2	1	1	1	1	2	-	1	-	2	3	1	-

UNIT-I

GPS Fundamentals: Introduction to Radio Navigation system: VOR, ILS. GPS System Segments: space, control and user segments, Principle of operation, Current status of GPS satellite constellation. Orbital Mechanics: GPS ephemeris data, algorithm for computation of satellite's position from ephemeris data. Time References: solar and sidereal days, UTC time, GPS time.

UNIT-II

GPS Signals: Legacy GPS signals: Signal structure, Operating frequencies, C/A and P-Code, Navigation message, Modernized GPS signals: list of signals and their significance. Range measurements: code and carrier measurements, User position estimation with PRN codes.

Coordinate Systems: Earth Centered Earth Fixed (ECEF) coordinate system, Earth Centered Inertial (ECI) coordinate system, Geodetic coordinate system, Ellipsoid and Geoid, Regional and Global Datum, World Geodetic System (WGS-84).

UNIT-III

GPS Error Sources: Satellite clock error, ephemeris error, Receiver clock errors, satellite and receiver instrumental bias, Multipath error, receiver measurement noise, ionospheric error and tropospheric error, Klobuchar model, ionospheric delay estimation using dual frequency measurements and UERE. Dilution of precision: HDOP, VDOP, TDOP, PDOP & GDOP.

UNIT-IV

Data Formats: RINEX Observation and Navigation Data formats, NMEA format.
GNSS: Architecture, operation and signals of other navigational satellite systems Galileo, Beidou and GLONASS, QZSS.
IRNSS: Architecture and signals.

UNIT-V

Differential GPS (DGPS): Principle of DGPS, Types of DGPS: Local Area DGPS (LADPS), Wide Area DGPS (WADGPS).
GPS Augmentation Systems: Principle of operation of Satellite Based Augmentation system (SBAS) and Ground Based Augmentation System (GBAS).
GNSS Applications: Surveying, Mapping, Marine, air and land Navigation, Military and Space Application.

Text Books:

1. Elliot D Kaplan and Christopher J Hegarty, "Understanding GPS principles and applications", Artech House Publishers, 2/e Boston & London 2005.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance", Ganga- Jamuna Press, 2/e, Massachusetts, 2010.

Suggested Reading:

1. B. Hofmann-Wellenhof, H. Lichtenegger, and J. Collins, "GPS Theory and Practice", Springer Verlog, 5/e, 2008.
2. Ahmed El-Rabbany, "Introduction to GPS", Artech House Publishers, 2/e, Boston 2006.
3. Bradford W. Parkinson and James J. Spilker, "Global Positioning system: Theory and Application", Vol.II, American Institution of Aeronautices and Astronautics Inc., Washington, 1996.

20EC E30

PATTERN RECOGNITION USING MACHINE LEARNING

(Professional Elective-V)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisite: The student should have knowledge of probability and random variables.

Course Objectives: This course aims to:

1. Model of pattern recognition using decision theory.
2. Develop of linear models for classification problems.
3. Analyze the unsupervised learning models and also clustering.

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

1. Understand the concepts of pattern recognition.
2. Apply the parametric and linear models for classification.
3. Design algorithms using neural networks for machine learning problems.
4. Implementation of Support Vector Machines (SVM) algorithm for real time applications.
5. Evaluate various unsupervised clustering techniques.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	-	2	-	-
CO2	3	2	1	2	2	-	-	-	-	-	-	1	3	2	1
CO3	3	2	3	2	3	-	-	-	-	-	1	2	3	2	2
CO4	3	2	3	2	3	-	-	-	-	-	1	1	3	2	2
CO5	3	2	3	2	2	-	-	-	-	-	2	2	3	3	2

UNIT-I

Introduction to Pattern Recognition: Pattern Recognition Systems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Bayesian Decision Theory, continuous Features, Minimum Error rate classification, Classifiers, Discriminant Functions and Decision surfaces, Bayesian Decision Theory- Discrete Features. Maximum-Likelihood and Bayesian parameter estimation: Maximum Likelihood estimation, Bayesian estimation.

UNIT-II

Linear Models: Linear Models for Regression: Linear Basis Function Models, The Bias -Variance Decomposition, Bayesian Linear Regression, Linear Models for Classification: Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, Bayesian Logistic Regression.

UNIT-III

Neural Network: Feed forward operation and classification: Multilayer Networks, back propagation algorithm: Network learning, Training protocols, Learning Curves, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning.

UNIT-IV

Linear Discriminant Functions: Decision surfaces: Two category case and multi category case, two-category Linearly separable case, Minimum- squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machines.

UNIT-V

Algorithm Independent Machine Learning: lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers.

Unsupervised Learning and Clustering: k-means clustering, fuzzy k-means clustering, Hierarchical clustering.

Text Books:

1. C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.

Suggested Reading:

1. B. Yagnanarayana, Artificial Neural Networks, Prentice Hall, New Delhi, 2007.

20IT O01

OBJECT ORIENTED ROGRAMMING USING JAVA

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Prerequisites: Programming for problem solving.

Course Objectives: This course aims to:

1. To familiarize with fundamentals of object-oriented programming paradigm.
2. To impart the knowledge of string handling, interfaces, packages and inner classes.
3. To acquaint with Exception handling mechanisms and Multithreading.
4. To gain knowledge on collection framework, stream classes.
5. To familiarize web application environment using Servlets and JSP

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

1. To understand fundamentals of object-oriented programming paradigm.
2. To apply knowledge of string handling, interfaces, packages and inner classes.
3. To implement Exception handling mechanisms and Multithreading.
4. To demonstrate knowledge on collection framework, stream classes.
5. To develop web applications using Servlets and JSP.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	-	-	-	-	1	-	-	-	1	-
CO2	-	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO3	-	1	1	1	-	-	-	-	-	-	3	-	-	1	-
CO4	1	2	1	1	-	-	-	-	-	-	3	1	-	-	-
CO5	1	2	1	2	3	-	-	1	3	-	3	1	-	1	-

UNIT-I

OOP concepts: Data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, classes and objects, Procedural and object oriented programming paradigms.

Introduction to Java: Java's Magic: The Byte code, The Java Buzzwords, Simple Java Programs, Java Primitive Types, Arrays: How to create and define arrays, Basic Operators, Control statements.

Introducing Classes: Declaring objects, methods, Constructors, this keyword, Method Overloading and Constructor Overloading, Objects as parameters, Returning objects, Use of static and final keywords.

UNIT-II

Inheritance: super and subclasses, Member access rules ,super keyword**,** Method overriding, Dynamic method dispatch , Abstract classes, using final with inheritance , Introduction to Object class.

Packages: Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages.

Interfaces: Defining and implementing interfaces, Nested Interfaces. **Strings Handling:** String & StringBuffer classes, String Tokenizer class and Wrapper classes and conversion between Objects and primitives.

Inner classes in Java: Types of inner classes, Creating static / non-static inner classes, Local and anonymous inner classes.

UNIT-III

Exception Handling in Java: what are Exceptions? Exception types**,** Usage of try, catch, throw, throws and finally clauses,

writing your own exception classes. **Multi-threading in Java:** The java Thread Model, how to create threads, Thread class in java, Thread priorities, Thread synchronization.
Generics: What are Generics? Generic classes, bounded types, Generic methods and interfaces.

UNIT-IV
Collections Framework: Overview of Collection Framework, Commonly used Collection classes – Array List, Linked List, Hash Set, Linked Hash Set, Tree Set, Collection Interfaces –Collection, List, Set, Sorted Set, Accessing a collection via an Iteration, Storing user-defined classes in collections, Map Interfaces and
Classes, Using a comparator. Legacy classes – Vector, Hash table, The Enumeration interface.
Input/Output : How to read user input (from keyboard) using scanner class, Stream classes, Input Stream, Output Stream, File Input Stream, File Output Stream, Reader and Writer, File Reader, File Writer classes. File class.

UNIT-V
Java Servlets: Overview of Java Servlet API, Servlet Implementation, Servlet Configuration, Servlet Exceptions, Servlet Life cycle, Request and Response methods, Approaches to Session tracking, Servlet Context, Servlet Collaboration.
JSP Basics: Introduction to JSP, Directives, Scripting Elements, Standard Actions.
Databases: Connect servlet to MySQL, Connect JSP to MySQL.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 8th Edition, Tata McGraw Hill Publications, 2011.
2. Kathy Sierra, Bryan Basham, Bert Bates, ―Head First Servlets and JSP‖, 2nd Edition, O'Reilly Media, Inc, 2008.

Suggested Reading:

1. E Balagurusamy "Programming with JAVA", 6th Edition , Tata McGraw-Hill Publishing company Ltd,2019.
2. Sachin Malhotra & Saurabh Choudhary, "Programming in Java", 2nd Edition, Oxford University Press, 2014.
3. C. Thomas Wu, "An introduction to Object-oriented programming with Java", 4th Edition, Tata McGraw-Hill Publishing company Ltd.,2010. 4. Kathy Sierra, Bert Bates, "Head First Java: A Brain-Friendly Guide"2nd Edition, O'Reilly,2005

Web Resources:
1. https://www.cse.iitb.ac.in/~nlp-ai/javalect_august2004.html.
2. http://nptel.ac.in/courses/106106147/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-092- introduction-to-programming-in-java-january-iap-2010/lecture-notes/

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20CS O09

FUNDAMENTALS OF DBMS

(Open Elective-I)

Instruction	3 L Hours per week
Duration of SEE	3 Hours
SEE	60 Marks
CIE	40 Marks
Credits	3

Course Objectives: This course aims to:

1. To learn data models, conceptualize and depict a database system using E-R diagrams.
2. To understand the internal storage structures in a physical DB design.
3. To learn the fundamental concepts of transaction processing techniques.

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

1. Classify the difference between FMS and DBMS; describe the roles of different users and the structure of the DBMS. Design the database logically using ER modeling
2. Outline the schema of the relational database and key constraints. Develop queries using DDL, DML and DCL of SQL.
3. Identify the inference rules for functional dependencies and apply the principles of normal forms to decompose the relations in a database.
4. Summarize the concepts of dense, sparse, ISAM and B+ tree indexing and get familiar with states and properties of transactions.
5. Interpret the locking, time stamp, graph and validation-based protocols for concurrency control.
6. Summarize log-based recovery techniques to increase the robustness of the database, identify to resolve the deadlocks in the transactions.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	3	3	1	-	-	-		-	-	-	-	2	1	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	1	1
CO4	1	2	2	2	-	-	-	-	-	-	-	-	1	1	2
CO5	3	3	2	1	-	-	-	-	-	-	-	-	2	2	2

UNIT - I

Introduction: Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Users and Administrators Database System Architecture, Application Architectures.

Database Design and E-R Model: Basic concepts, Constraints, E-R Diagrams, E-R Design Issues, Extended E-R Features, Specialization and Generalization.

UNIT - II

Relational Model: Structure of Relational Databases, Database Schema, Keys.

Structured Query Language: Overviews, SQL Data Types, SQL Queries, Data Manipulation Language Set Operations, Aggregate Functions, Data Definition Language, Integrity Constraints, Null Values, Views, Join Expression. Index Definition in SQL.

UNIT - III

Relational Database Design: Undesirable Properties in Relational Database Design, Functional Dependencies, Trivial and Nontrivial Dependencies, Closure of Set of Functional Dependencies, Closure of Set of Attributes, Irreducible Set of Functional Dependencies, Normalization – 1NF, 2NF, and 3NF, Dependency Preservation, BCNF, Comparison of BCNF and 3NF.

UNIT - IV

Indexing: Basic concepts, Dense and Sparse Indices, Secondary Indices, Tree-Structured Indexing, Indexed Sequential Access Method (ISAM), B+ Tree Index Files.

Transaction Management: Transaction Concept – ACID Properties, States of Transaction, Implementation of Atomicity and Durability, Serializability, Recoverability.

UNIT - V

Concurrency Control: Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols.

Deadlocks Handling: Deadlock Prevention, Deadlock Detection and Recovery.

Recovery System: Failure Classification, Storage Structure, Recovery and Atomicity, Log-Based Recovery.

Text Books:

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill International Edition, 2011.
2. Date CJ, Kannan A, Swamynathan S, "An Introduction to Database Systems", Eight Edition, Pearson Education, 2006.

Suggested Reading:

1. Raghu Ramakrishnan, JohnnesGehrke, "Database Management Systems", Third Edition, McGraw Hill, 2003.
2. Ramez Elmasri, Durvasul VLN Somayazulu, Shamkant B Navathe, Shyam K Gupta, "Fundamentals of Database Systems", Fourth Edition, Pearson Education, 2006.

20ECC24

ELECTRONIC DESIGN AND AUTOMATION LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Digital design fundamentals and synthesis & simulation concepts

Course Objectives: This course aims to:

1. Simulate and synthesize combinational and sequential logic circuits
2. Simulate switch level modules
3. Learn implementation procedure for any design on FPGA and to study the speed, power and area constraints of FPGA/CPLD

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

1. Demonstrate the process steps required for simulation /synthesis
2. Develop HDL codes/scripts with appropriate syntax
3. Apply an appropriate modelling style to describe various combinational and sequential circuits in Verilog HDL
4. Examine the successful execution of the codes/ schematic using various Simulation Tools
5. Build various digital circuits on hardware boards like FPGA.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	1	-	-	2	2	-	-	2	1	3	1
CO2	-	-	-	1	2	-	-	2	2	-	-	2	1	3	1
CO3	1	1	1	1	2	-	-	2	2	-	-	2	1	3	1
CO4	-	-	-	1	3	-	-	2	2	-	-	2	1	3	1
CO5	-	-	-	1	1	-	-	2	2	-	-	2	1	3	1

List of Experiments

Part A

Write VERILOG Code, Simulate and Implement the following on FPGA:

1. Code Converters.
2. Encoders, Decoders, Priority Encoder and Comparator.
3. Registers/Counters.
4. Sequence Detector using Mealy and Moore type state machines.
5. Any application of UDP.
6. Tasks and Functions.

Note:

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioural Modelling.
2. All the programs should be simulated using test benches.

Part B

Switch Level Modelling of CMOS circuits: Basic Logic Gates: Inverter, NAND and NOR.

1. Half Adder and Half Subtractor.
2. 4x1 Multiplexer.
3. 2x4 Decoder.
4. Design of NAND Gate using Simulation tool.
5. Design of NOR Gate using Simulation tool.
6. Design and layout of Inverter using Simulation tool.

Structured Enquiry Program:

1. Design and simulate a high-speed adder using Verilog HDL

Open- ended Enquiry:

1. Simulate a design using System Vivado and implement the same on Zynq Evaluation Development Board.

Suggested Reading:

1. Michal D. Ciletti, "Advanced digital design with Verilog HDL", Pearson Edition, 2011.
2. Samir Palnitkar, "Verilog HDL-A Guide to Digital Design and Synthesis", Pearson 2nd edition, 2003.
3. Cadence Design Systems (Ireland) Ltd., "Cadence manual", 2013.

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20ECC25

MICROCONTROLLERS LAB

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: Basic knowledge of programming in C language.

Course Objectives: This course aims to:

1. Develop and understand the 8051 and ARM7 C programming
2. Understand the usage of Integrated Development Environment (Keil)
3. Control the operation of various peripherals using 8051 and ARM7 microcontroller

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

1. Develop the programs of 8051 and ARM using their respective instruction set.
2. Understand the usage of various debugging tools available to program different microcontrollers
3. Build code for 8051 and ARM7 to interface various input/output modules
4. Analyze the hardware and software interaction and integration.
5. Design and develop the 8051 and ARM 7 based embedded systems for various applications

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	2	2	3	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	3	3	3	-	-	-	-	-	-	-	3	2	2
CO3	2	3	2	3	3	-	-	-	-	-	-	2	3	3	2
CO4	3	2	3	3	3	-	-	-	-	-	-	2	2	2	3
CO5	3	2	3	3	3	2	1	-	2	-	1	2	3	2	3

List of Experiments

II. 8051 Programming

1. Familiarity and use of 8051 microcontroller trainer kit, Keil IDE and simple programs under different addressing modes.
2. Assembly programming using instruction set
3. Timer and counter operations and programming using 8051.
4. Interfacing applications using LED, switch, relay and buzzer.
5. Generation of waveforms using DAC by interfacing it with 8051.
6. Stepper motor interfacing.
7. LCD interfacing.
8. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

III. ARM7 Programming

1. Study and use of LPC214x Microcontroller trainer kit and simple programs using its instruction set
2. Interfacing applications using LED, switch, relay and buzzer.

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3. DC Motor interfacing.
4. Programming on-chip ADC.
5. Waveform generation using internal DAC.
6. Development of Embedded 'C' Code based on the module specifications. (under Structured enquiry)

IV. Design an experiment related to the Embedded Application of your choice using 8051/ARM based architectures. (under Open ended enquiry)

Suggested Reading:

1. Mazidi M.A, Mazidi JG & Rolin D. Mckinlay, "The 8051 Microcontroller & Embedded Systems using Assembly and C", 2/e, Pearson Education, 2007.
2. Philips semiconductors, "ARM 7 (LPC 214x) user manual", 2005.

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20ECC26

MINI PROJECT

Instruction	2P Hours per Week
Duration of SEE	--
SEE	--
CIE	50 Marks
Credits	1

Prerequisite: Knowledge of Electronic circuits and Communication systems

Course Objectives: This course aims to:

1. To enable students learning by practical realization.
2. To develop capability to analyse and solve real world problems.
3. To develop technical writing and presentation skills.

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

1. Formulate mini project proposal through literature survey.
2. Plan, design and analyze the proposed mini project.
3. To simulate and execute the mini project for validation.
4. Enhance oral presentation skills.
5. Prepare and submit the mini project report.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PSO2	PSO3
CO1	2	3	2	2	-	2	1	1	3	-	2	3	2	3	2
CO2	1	3	2	2	-	-	-	-	3	-	1	2	1	3	2
CO3	-	2	1	2	2	-	-	-	3	-	-	-	-	2	1
CO4	-	-	-	-	-	-	-	-	3	3	1	-	-	-	-
CO5	-	-	-	1	-	-	-	-	3	3	1	-	-	-	-

The students are required to choose emergent technology topic for mini project related to domain. The students have to design and simulate/ implement as per the given schedule. Students have to give oral presentation in presence of department review committee, finally report of the mini project work has to be submitted for evaluation.

Schedule

S. no	Description	Duration
1	Problem identification/selection	**2 weeks**
2	Preparation of abstract	**1 Week**
3	Design, implementation and testing of the project	**7 Weeks**
4	Documentation and mini project presentation	**4 Weeks**

Guidelines for the Evaluation

S. no	Description	Maximum Marks
1	Weekly Assessment	**20**
2	PPT preparation	**5**

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3	Presentation	**10**
4	Queries and Answers	**5**
5	Documentation of mini project	**10**
	Total	**50**

Guidelines:

1. Each student will be allotted to a faculty supervisor for mentoring.
2. Mini projects maybe targeted to achieve practical competences.
3. Mini projects shall have inter-disciplinary/ industry relevance.
4. All the results obtained are to be clearly presented and documented with the reasons/explanations.

HEAD
DEPARTMENT OF ECE
Chaitanya Bharathi Institute of Technology
Hyderabad-500 075

20EG C03

EMPLOYABILITY SKILLS

(BE/BTech V & VI semester - Common to all Branches)

Instruction	2 P Hours per Week
Duration of SEE	3 Hours
SEE	50 Marks
CIE	50 Marks
Credits	1

Prerequisite: No specific prerequisite is required

Course Objectives: This course aims to:

1. Learn the art of communication, participate in group discussions and case studies with confidence and to make effective presentations.
2. With- resume packaging, preparing them to face interviews.
3. Build an impressive personality through effective time management, leadership qualities, self-confidence and assertiveness.
4. Understand professional etiquette and to make them learn academic ethics and value system.
5. To be competent in verbal aptitude.

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

1. Become effective communicators, participate in group discussions with confidence and be able to make presentations in a professional context.
2. Write resumes, prepare and face interviews confidently.
3. Be assertive and set short term and long term goals, learn to mange time effectively and deal with stress.
4. Mak**e** the transition smoothly from campus to work, use media with etiquette and understand the academic ethics.
5. Enrich their vocabulary, frame accurate sentences and comprehend passages confidently.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	2	2	2	-	-	-	1
CO2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO4	-	2	-	-	-	-	-	2	-	-	2	-	-	-	1
CO5	-	-	-	-	-	2	-	-	-	-	-	-	-	-	1

UNIT I

Verbal Aptitude: Error Detection, Articles, Prepositions, Tenses, Concord and Transformation of Sentences-Jumbled Words/Sentences- Vocabulary, Synonyms, Antonyms, One Word Substitutes, Idioms and Phrases, Word/Sentence/Text Completion- Reading Comprehension.

UNIT II

Group Discussion & Presentation Skills: Dynamics of Group Discussion-Case Studies- Intervention, Summarizing, Modulation of Voice, Body Language, Relevance, Fluency and Accuracy, Coherence. Elements of Effective Presentation – Structure of a Presentation – Presentation tools – Body language - Preparing an Effective PPT

UNIT III

Behavioural Skills: Personal strength analysis-Effective Time Management- Goal Setting- Stress management- **Corporate Culture** – Grooming and etiquette-Statement of Purpose (SOP).

UNIT IV

Mini Project: Research-Hypothesis-Developing a Questionnaire-Data Collection-Analysis-General and Technical Report - Writing an Abstract –Technical Report Writing-Plagiarism-Project Seminar.

UNIT V

Interview Skills: Cover Letter and Résumé writing – Structure and Presentation, Planning, Defining the Career Objective, Projecting ones Strengths and Skill-sets – Interviews: Concept and Process, Pre-Interview Planning, Opening Strategies, Answering Strategies, Mock Interviews.

Text Books:

1. Leena Sen, "Communication Skills", Prentice-Hall of India, 2005
2. Dr. Shalini Verma, "Body Language - Your Success Mantra", S Chand, 2006
3. Edgar Thorpe and Showick Thorpe , "Objective English", 2nd edition, Pearson Education, 2007
4. Ramesh, Gopalswamy, and Mahadevan Ramesh, "The ACE of Soft Skills", New Delhi: Pearson, 2010

Suggested Reading:

1. Gulati and Sarvesh, " Corporate Soft Skills", New Delhi: Rupa and Co. , 2006
2. Van Emden, Joan, and Lucinda Becker, "Presentation Skills for Students", New York: Palgrave Macmillan, 2004
3. A Modern Approach to Verbal & Non-Verbal Reasoning by R S Aggarwal, 2018
4. Covey and Stephen R, "The Habits of Highly Effective People", New York: Free Press, 1989