For the academic years 2020-2024

FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(AICTE Model Curriculum)

and

Syllabi

of

Four Year Degree Program of

Bachelors of Engineering(B.E)

ELECTRONICS & COMMUNICATION ENGINEERING

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2020

For the academic years 2020-2024

Mission and Vision of Osmania University

The Vision	The Vision of the University is to generate and disseminate knowledge through a harmonious blend of ancient and modern wisdom, and to serve the society by developing in students heightened intellectual, cultural, ethical, and humane sensitivities; to foster a scientific temper, and to promote professional and technological expertise. Central to this vision is a commitment to regional and national development in consonance with our culture, heritage, and environment.
The Mission	• To achieve excellence in teaching and research. • To generate, disseminate and preserve knowledge. • To meet the challenges of a complex, and modern society through informed social outreach. • To empower through knowledge and information. • To develop a responsible and productive citizenry. • To develop, enhance, and improve the quality of human resources. • To cultivate resolute moral and ethical values. • To meet contemporary regional and national needs and anticipate future social and economic development. • To preserve and promote cultural heritage, humanistic and spiritual values.

Program Outcomes

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. I- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/ D	Contact Hrs/W	CIE	SEE	Duration in Hrs	
MC: Three Week Induction Programme										
Theory Course										
1	MC 801 PO	Indian Constitution	2	-	-	2	30	70	3	-
2	BS 201 MT	Mathematics-I	3	1	-	4	30	70	3	4
3	BS 202 PH	Engineering Physics	3	1	-	4	30	70	3	4
4	ES 301 EE	Basic Electrical Engineering	3	1	-	4	30	70	3	4
Practical/Laboratory Course										
5	BS 251 PH	Engineering Physics Lab	-	-	2	2	25	50	3	1.5
6	ES 354 EE	Basic Electrical Engineering Lab	-	-	2	2	25	50	3	1
7	ES 353 CE	Engineering Graphics	1	-	5	6	50	50	3	3
Total			**12**	**3**	**9**	**24**	**220**	**430**	**21**	**17**

MC: Mandatory Course **BS:** Basic Science **ES:** Engineering Science

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

PO: Political Science **MT:** Mathematics **PH:** Physics
EE: Electrical Engineering **CE:** Civil Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

For the academic years 2020-2024

INDIAN CONSTITUTION

MC 801 PO

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : -

Objectives:

1. To create awareness among students about the Indian Constitution and To acquaint the working conditions of union, state, local levels, their powers and functions.
2. To create consciousness in the students on democratic values and principles articulated in the constitution and To expose the students on the relations between federal and provincial units.
3. To divulge the students about the statutory institutions.

Outcomes: On successful completion of the course, the students would be able to

1. Know the background of the present constitution of India.
2. Understand the working of the union, state and local levels.
3. Gain consciousness on the fundamental rights and duties.
4. Be able to understand the functioning and distribution of financial resources between the centre and states.
5. Be exposed to the reality of hierarchical Indian social structure and the ways the grievances of the deprived sections can be addressed to raise human dignity in a democratic way.

UNIT – I
Evolution of the Indian Constitution: 1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.
UNIT – II
Union Government: Executive-President, Prime Minister, Council of Minister ***State Government:*** Executive: Governor, Chief Minister, Council of Minister ***Local Government:*** Panchayat Raj Institutions, Urban Government
UNIT – III
Rights and Duties: Fundamental Rights, Directive principles, Fundamental Duties
UNIT – IV
Relation between Federal and Provincial units: Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India
UNIT – V
Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

Suggested Reading:

1.	D.D. Basu, '*Introduction to the constitution of India'*, Lexis Nexis, New Delhi
2.	Subhash Kashyap, '*Our Parliament'*, National Book Trust, New Delhi
3.	Peu Ghosh, '*Indian Government &Politics'*, Prentice Hall of India, New Delhi
4.	B.Z. Fadia & Kuldeep Fadia, '*Indian Government &Politics'*, Lexis Nexis, New Delhi

For the academic years 2020-2024

MATHEMATICS – I

BS 201 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To introduce the concepts of sequences, series and their properties
2. To introduce the concepts of functions of several variables and multiple integrals
3. To study vector differential and integral calculus

Outcomes: On successful completion of the course, the students would be able to

1. Find the nature of sequences and series
2. Evaluate multiple integrals
3. Apply this knowledge to solve the curriculum problems
4. Implement the concepts of Multivariable calculus
5. Understand the relevance of vectors to field of engineering.

UNIT – I
Sequences and Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests, tests of Convergence D'Alembert's ratio test, Cauchy's n^{th} root test, Raabe's test, Logarithmic test, Alternating series, Series of positive and negative terms, Absolute convergence and Conditional convergence.
UNIT – II
Calculus of one Variable: Rolle's theorem, Lagrange's, Cauchy's mean value theorems, Taylor's series, Curvature, Radius of curvature, Circle of curvature, Envelope of a family of curves, Evolutes and Involutes.
UNIT – III
Multivariable Calculus (Differentiation): Functions of two variables, Limits and continuity, Partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions (Chain rule), Change of variables, Jacobian, Higher order partial derivatives, Taylor's series of functions of two variables, Maximum and minimum values of functions of two variables, Lagrange's method of undetermined multipliers.
UNIT – IV
Multivariable Calculus (Integration): Double integrals, Change of order of integration, Change of Variables from Cartesian to plane polar coordinates, Triple integrals.
UNIT – V
Vector Calculus: Scalar and vector fields, Gradient of a scalar field, Directional derivative, Divergence and Curl of a vector field, Line, Surface and Volume integrals, Green's theorem in a plane, Gauss's divergence theorem, Stoke's theorem (without proofs) and their verification.

Suggested Reading:

1.	R.K. Jain & S.R.K Iyengar, '*Advanced Engineering Mathematics'*, Narosa Publications, 2014.
2.	Erwin Kreyszig, '*Advanced Engineering Mathematics'*, John Wiley, 9th Edition, 2012.
3.	B.S. Grewal, '*Higher Engineering Mathematics'*, Khanna Publications, 43rd Edition, 2014.
4.	G.B. Thomas, Maurice Weir and Joel Hass, Thomas' '*Calculus*', Peterson, 12th Edition,2010.
5.	B.V. Ramana, '*Higher Engineering Mathematics*', 23rd reprint, 2015.

ENGINEERING PHYSICS

BS 202 PH

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Aware of limits of classical free electron free theory and to apply band theory of solids
2. Acquire knowledge on various properties of semiconductors.
3. Grasp the intricacies in semiconductor-optical interaction

Outcomes: On successful completion of the course, the students would be able to

1. Distinguish materials based on band theory of solids 3.
2. Classify semiconductors on the basis doping and to estimate conductivity and learn transport phenomenon in semiconductors
3. Appreciate use of optical absorption by semiconductors.
4. Understand the properties of Magnetic materials and superconductivity
5. Understand the operation of LASERS and its applications to optical fibres.

UNIT – I
Crystallography: Introduction, Types of crystal systems, Bravais lattices, Lattiee planes and Miller Indices (Cubic system), Inter planar spacing (Cubic system), Bragg's law, Powder diffraction method. ***Crystal Defects:*** Classification of point defects, Concentration of Schottky defects in metals and ionic crystals, Concentration of Frankel defects, Line defects, Screw and Edge dislocations, Burger's vector
UNIT – II
Band Theory of Solids & Semiconductors: Classical free electron theory (qualitative), Kronig Penney model (qualitative treatment), Energy band formation in solids, Intrinsic and Extrinsic semiconductors, Concept of a hole, Carrier concentration and conductivity in intrinsic semiconductors, Formation of P-N junction diode and its I – V characteristics, Thermistor and its characteristics, Hall effect and its applications. ***Dielectric Materials:*** Dielectrics, Types of polarizations, Electronic, Ionic, Orientational and Space charge polarizations, Expression for Electronic polarizability, Frequency and temperature dependence of dielectric polarizations, Determination of dielectric constant by capacitance Bridge method, Ferro electricity, Barium titanate, Applications of Ferroelectrics.
UNIT – III
Wave Mechanics: Matter waves –de-Broglie wavelength, properties of wave function, Physical significance, Schrodinger time dependent and time in-dependent wave equation. Particle in a 1-D box. ***Electromagnetic theory:*** Basic laws of electricity and magnetism, Maxwell's equations in integral and differential forms, Conduction and displacement current, Relation between D, E and P – ***Electromagnetic waves:*** Equation of plane wave in free space, Poynting theorem.
UNIT – IV
Magnetic Materials: Classification of magnetic materials: dia, para, ferro, antiferro and ferrimagnetic materials, Weiss molecular field theory of ferromagnetism, Magnetic domains, Hysteresis curve, soft and hard magnetic materials, Ferrites: Applications of ferrites. ***Superconductivity:*** Introduction, General properties of super conductors, Meissner effect, Type

I and Type II superconductors, BCS theory (qualitative), Introduction to High Tc superconductors, Applications of superconductors.
UNIT – V
Lasers: Characteristics of Lasers, spontaneous and stimulated emission of radiation, Einstein's Coefficients, population inversion, Ruby Laser, Helium Neon Laser, Semi-Conductor Laser and applications of lasers. ***Fiber Optics:*** Introduction, Propagation of light through an optical fiber, Acceptance angle, Numerical aperture (NA), Types of Optical fibers and Refractive index profiles, Fiber drawing process (double Crucible Method), Losses in optical fibers, applications of optical fibers.

Suggested Reading:

1.	B.K. Pandey and S. Chaturvedi ,*'Engineering Physics*' Cengage Learning 2012
2.	A.K. Bhandhopadhya, '*Nano Materials'*, New Age International, 1st Edition, 2007
3.	M.S. Avadhanulu and P.G. Kshirusagar, '*Engg. Physics'*, S. Chand & Co. 1st Edition, 1992.
4.	C.M. Srivastava and C. Srinivasan – '*Science of Engg Materials'*, New Age International.
5.	R.K Gaur and S.L Gupta- '*Engineering Physics'*, Dhanpathrai Publications, New edition.
6.	Sanjay D Jain & Girish G Sahasrabudhe –'*Engineering Physics'*, University Press

For the academic years 2020-2024

BASIC ELECTRICAL ENGINEERING

ES 301 EE

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To provide an understanding of basics in Electrical circuits.
2. To explain the working principles of Electrical Machines and single phase transformers.
3. To apply the principles of Electrical engineering for domestic and industrial safety.

Outcomes: On successful completion of the course, the students would be able to

1. To analyze Electrical circuits to compute and measure the parameters of Electrical Energy.
2. To comprehend the working principles of Electrical DC Machines.
3. To Identify and test various Electrical switchgear, single phase transformers and assess the ratings needed in given application.
4. To comprehend the working principles of electrical AC machines.
5. Appreciate the safety electric installations in domestic and industrial setups

UNIT – I
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton 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, and RL, RC, RLC combinations (series only). Three phase balanced circuits, voltage and current relations in star and delta connections.
UNIT – III
Transformers and 3-ph Induction Motors: Transformers: Electromagnetic induction, Faradays laws, statically induced emf, Lenz law, BH characteristics, ideal and practical transformer, losses and efficiency, Auto-transformer and three-phase transformer connections. ***Three Phase Induction motor:*** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, squirrel cage IM, slip-ring IM, Applications.
UNIT – IV
Single-phase induction motor & DC Machines: Single-phase induction motor: Construction and principle of operation, Capacitor start & capacitor run motor, applications ***DC Generators:*** Dynamically induced emf, Flemming's Right hand and Left hand rules, Construction and principle of operation of DC generator, EMF equation, Types of DC Generators, OCC characteristics, applications ***DC Motors:*** principle of operation of DC Motor, Types of DC motors, applications.
UNIT – V
Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Reading:

1.	N.K. De, '*Basic Electrical Engineering'*, Universities Press, 2015.
2.	J.B. Gupta, '*Fundamentals of Electrical Engineering and Electronics'* S.K. Kataria & Sons Publications, 2002.
3.	J.B. Gupta, '*Utilization of Electric Power and Electric Traction'* S.K. Kataria & Sons Publications, 2010
4.	Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, '*Basic Electrical Engineering'* Tata McGraw Hill, Publications,2009
5.	Hughes, '*Electrical Technology'*, VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

ENGINEERING PHYSICS LAB

BS 251 PH

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1. Make precise measurements using basic physical principles and acquire skills to handle the instruments.
2. Relates the theoretical Knowledge to the behavior of Practical Physical world and Analyze errors in the experimental data.
3. Plot graphs between various physical parameters.

Outcomes: On successful completion of the course, the students would be able to

1. Conduct experiments, take measurements independently.
2. Write appropriate laboratory reports.
3. Compute and compare the experimental results and draw relevant conclusions.
4. Use the graphical representation of data and estimate results from graphs
5. Appreciate the application of physical phenomena to the real world.

List of Experiments:

1. To determine the Dielectric constant and Phase transition temperature of Lead Zirconium Titanate (PZT).
2. To draw the I - V Characteristics of P-N Junction diode and to evaluate the resistance.
3. To find the values of Electrical conductivity and energy gap of Ge crystal.
4. Determination of rigidity of modulus of Torsion pendulum.
5. Determination of carrier concentration, Mobility and Hall Coefficient of Ge crystal using Hall Effect Experiment.
6. To determine the constants of A, B and α using Thermistor characteristics.
7. To draw the curve between the magnetizing field and the intensity of magnetization of the specimen (soft iron rod) and to find out i) Coercivity ii) Retentivity and iii) Hysteresis loss.
8. To draw the I - V Characteristics of a solar cell and to calculate the i) Fill factor Efficiency and ii) Series resistance.
9. To Determine the Numerical aperture (NA) of Optical fiber.
10. To determine the wave length of the given Laser source.

Note: Minimum eight experiments should be conducted in the semester

Suggested Reading:

1. N.K. De, '*Basic Electrical Engineering'*, Universities Press, 2015.
2. J.B. Gupta, '*Fundamentals of Electrical Engineering and Electronics'* S.K. Kataria & Sons Publications, 2002.
3. J.B. Gupta, '*Utilization of Electric Power and Electric Traction'* S.K. Kataria & Sons Publications, 2010

BASIC ELECTRICAL ENGINEERING LAB

ES 354 EE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1.5

Objectives:

1. To impart the practical knowledge on testing of DC Machines
2. To impart the practical knowledge on testing of AC
3. To impart the practical knowledge on the usage of common electrical measuring instruments

Outcomes: On successful completion of the course, the students would be able to

1. Get an exposure to common electrical components and their ratings.
2. Analyze the performance of DC and AC Machines.
3. Comprehend the usage of common electrical measuring instruments.
4. Test the basic characteristics of transformers and electrical machines.
5. Appreciate the application of Electrical phenomena to the real world.

Suggested List of Laboratory Experiments/Demonstrations:

Dem1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
Exp 1. Verification of KVL and KCL, superposition theorem (with DC excitation)
Exp 2 Verification of Thevinens and Nortons theorems (with DC excitation)
Exp 3. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Power factor calculation.
Exp 4. Transformers: Observation of the no-load current waveform on an oscilloscope (nonsinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics).
Exp 5. Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
Exp 6. Three-phase transformers: Star and Delta connections. Voltage and Current relationships (lineline voltage, phase-to-neutral voltage, line and phase currents).
Exp 7. Measurement of phase voltage/current, line voltage/current and power in a balanced three-phase circuit connected in star and delta
Dem2. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
Exp 8. OCC characteristics of DC Generator
Exp 9. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
Exp 10. Power factor improvement of Induction Motor using static capacitors
Exp 11. Load Test of DC Motor

Note - 1:
(i) List of Experiments and Demonstrations suggested above are already available in the Laboratory of the electrical department. No need to purchase any extra equipment except Demonstration2 equipments
(ii) Procurement of Demonstration 2 equipments can be done during the course work of that semester. It can be included in the laboratory.

Note - 2:
(i) Experiments 9, 10 and Demonstration 3 can be incorporated in the Lab syllabus if the topics concerned to the above experiments are considered in new BEE syllabus.

Suggested Reading:

1. N.K. De, '*Basic Electrical Engineering'*, Universities Press, 2015.
2. J.B. Gupta, '*Fundamentals of Electrical Engineering and Electronics'* S.K. Kataria & Sons Publications, 2002.
3. J.B. Gupta, '*Utilization of Electric Power and Electric Traction'* S.K. Kataria & Sons Publications, 2010
4. Abhijit Chakrabarti, Sudipta Nath, Chandan Kumar Chanda, '*Basic Electrical Engineering*' Tata McGraw Hill, Publications,2009
5. Hughes, '*Electrical Technology'*, VII Edition, International Student -on, Addison Welsey Longman Inc., 1995.

For the academic years 2020-2024

ENGINEERING GRAPHICS

ES 353 CE

Instruction: 1+5 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 50 marks*
Credits : 3

Objectives:

1. To prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. To prepare you to communicate effectively
3. To prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Outcomes: On successful completion of the course, the students would be able to

1. Introduction to engineering design and its place in society
2. Exposure to the visual aspects of engineering design
3. Exposure to engineering graphics standards
4. Exposure to solid modeling
5. Exposure to computer-aided geometric design
6. Exposure to creating working drawings
7. Exposure to engineering communication

Sheet No	**Description of the Topic**	**Contact Hours**	
		Lecture	**Drawing**
1.	Principles of Engineering Graphics and their significance, usage of drawing instruments.	1	
2.	Conic Sections – I Construction of ellipse, parabola and hyperbola given focus and eccentricity	1	2
3.	Conic Sections – II Construction of ellipse (given major and minor axis), parabola (given base and height), rectangular hyperbola.		2
4.	Cycloids (cycloid & epicycloid)	1	2
5.	Involutes (involute of triangle, square & circle)		2
6.	Scales (plain & diagonal scales)	1	2+2
7.	Introduction to AutoCAD Basic commands and simple drawings.		2+2
8.	Orthographic Projection Projections of points situated in different quadrants.	1	2
9.	Projections of straight lines – I Line parallel to both the reference planes, line perpendicular or inclined to one reference plane.	1	2
10.	Projections of straight lines – II Line inclined to both the reference planes.	1	2
11.	Projections of planes – I Perpendicular planes	1	2
12.	Projections of planes – II Oblique planes		2
13.	Projections of solids – I Polyhedra and solids of revolution, Projections of solids in simple position.	1	2

14.	Projection of solids – II Projections of solids when the axes inclined to one or both the reference planes.	1	2+2
15.	Section of solids – I When the sectional plane is parallel or perpendicular to one reference plane.	1	2
16.	Section of solids – II When the sectional plane is inclined to one reference plane.		2
17.	Development of surfaces – I Prisms and Cylinders	1	2
18.	Development of surfaces – II Pyramids and Cones		2
19.	Intersection of surfaces – I Intersection of cylinder and cylinder	1	2
20.	Intersection of surfaces – II Intersection of cylinder and cone		2
21.	Isometric projection – I planes and simple solids	1	2
22.	Isometric projection – II combination of two or three solids		2
23.	Conversion of Isometric Views to Orthographic Views	1	2
24.	Floor plans of 2 or 3 rooms including windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	2

Suggested Text:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), '*Engineering Drawing*', Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), '*Engineering Drawing and Computer Graphics'*, Pearson Education
3. S.N Lal, '*Engineering Drawing with Introduction to Auto CAD'*, Cengage Learning India Pvt Lid, New Delhi, 2018.
4. Agrawal B. & Agrawal C. M. (2012), '*Engineering Graphics'*, TMH Publication
5. Narayana, K.L. & P Kannaiah (2008), '*Text book on Engineering Drawing'*, Scitech Publishers
6. (Corresponding set of) CAD Software Theory and User Manuals

NOTE:

1. At least 20 sheets must be covered.
2. Sheet number 1 to 6 (Graph sheets / drawing sheets)
3. Sheet number 7 to 24 (AutoCAD drawings)

SCHEME OF INSTRUCTION & EXAMINATION
B.E. II- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/W	CIE	SEE	Duration in Hrs	
Theory Course										
1	MC 802 CE	Environmental Science	2	-	-	2	30	70	3	-
2	MC 803 PY	Essence of Indian Traditional Knowledge	2	-	-	2	30	70	3	-
3	HS 101 EG	English	2	-	-	2	30	70	3	2
4	BS 203 MT	Mathematics-II	3	1	-	4	30	70	3	4
5	BS 204 CH	Engineering Chemistry	3	1	-	4	30	70	3	4
6	ES 351 CS	Programming for Problem Solving	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	HS 151 EG	English Lab	-	-	2	2	25	50	3	1
8	BS 252 CH	Engineering Chemistry Lab	-	-	2	2	25	50	3	1.5
9	ES 353 CS	Programming for Problem Solving Lab	-	-	4	4	25	50	3	2
10	ES 352 ME	Workshop / Manufacturing Process	1	-	5	6	50	50	3	3
Total			**16**	**2**	**12**	**30**	**305**	**620**	**30**	**20**

HS: Humanities and Social Sciences **BS:** Basic Science **ES:** Engineering Science
MC: Mandatory Course

L: Lectures **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

PY: Philosophy **EG:** English **MT:** Mathematics **CH:** Chemistry
CE: Civil Engineering, **CS:** Computer Science and Engineering, **ME:** Mechanical Engineering.

Note:

1. Each contact hour is a Clock Hour.
2. The students have to undergo a Summer Internship of Rural Agriculture Work Experience (RAWE) of one week duration after II-Semester and credits will be awarded in VII semester after evaluation.
3. Rural Agriculture Work Experience helps the students primarily to understand the rural situations, status of Agricultural Technologies adopted by farmers and village development plans and to develop skills & attitude of working with farm families for overall development in rural area.
4. The main objectives of RAWE component are:
   - To make the students familiar with socio-economic conditions of the farmers.
   - To develop communication skills in students using extension teaching methods in transfer of Technology wherever necessary, to enable the student to complete the experiment.

ENVIRONMENTAL SCIENCE

MC 802 CE

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : -

Objectives:

1. To create awareness and impart basic knowledge about the environment and its allied problems.
2. To know the functions of ecosystems and To understand importance of biological diversity.
3. To study different pollutions and their impact on environment and To know social and environment related issues and their preventive measures.

Outcomes: On successful completion of the course, the students would be able to

1. Adopt environmental ethics to attain sustainable development.
2. Develop an attitude of concern for the environment.
3. Conservation of natural resources and biological diversity.
4. Creating awareness of Green technologies for nation's security.
5. Imparts awareness for environmental laws and regulations.

UNIT – I
The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, need for public awareness. ***Natural Resources:*** Water Resources – Use and over utilization of surface and ground water, flood, drought, conflicts over water, Dams: Benefits and Problems. Food Resources –World Food Problems, effects of modern agriculture, fertilizer-pesticides problems, water logging, salinity, Forest Resources – Use and over exploitation, deforestation & its effect on tribal people.Land Resources –Land Degradation, environmental effect of mining, man induced landslides, soil erosion and desertification. Energy Resources –Growing energy needs, Renewable and Non-renewable energy resources
UNIT – II
Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in ecosystem, food chains, ecological pyramids, ecological succession, types of ecosystems (marine, pond, river, forest, grassland, desert)
UNIT – III
Biodiversity: Levels of Biodiversity, Bio-geographical classification of India, Value of biodiversity, Threats to biodiversity, endangered and endemic species of India, Conservation of biodiversity, global and national efforts.
UNIT – IV
Environmental Pollution: Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution, solid waste management. ***Environment Protection Act:*** Air, water, forest and wildlife Acts, issues in the enforcement of environmental legislation.
UNIT – V
Social Issues and the Environment: Watershed management and environmental ethics. Climate change, global warming, acid rain, ozone layer depletion.

Environmental Disaster Management: Types of disasters, impact of disasters on environment, infrastructure, and development. Basic principles of disaster mitigation, disaster management, and methodology. Disaster management cycle and disaster management in India.

Field Work:

- Visit to a local area to document environmental issues- agricultural area/ pond/lake/terrestrial ecosystem
- Visit to a local polluted area- market/slum area/Industrial area/traffic area

Suggested Reading:

1.	A.K. De, '*Environmental Chemistry',* Wiley Eastern Ltd.
2.	E.P. Odum, '*Fundamentals of Ecology',* W.B. Sunders Co., USA.
3.	M.N. Rao and A.K. Datta, '*Waste Water Treatment'*, Oxford and IBK Publications.
4.	Benny Joseph, '*Environmental Studies'*, Tata McGraw Hill, 2005.
5.	V.K. Sharma, '*Disaster Management'*, National Centre for Disaster Management, IIPE,1999.

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

MC 803 PY

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : -

Objectives:

1. To get a knowledge in Indian Culture
2. To Know Indian Languages and Literature and the fine arts in India
3. To explore the Science and Scientists of Medieval and Modern India

Outcomes: On successful completion of the course, the students would be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.

UNIT – I
Introduction to Culture: Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India
UNIT – II
Indian Languages, Culture and Literature: Indian Languages and Literature-I: the role of Sanskrit, significance of scriptures to current society, Indian philosophies, other Sanskrit literature, literature of south India ***Indian Languages and Literature-II:*** Northern Indian languages & literature
UNIT – III
Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)
UNIT – IV
Fine Arts in India (Art, Technology& Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India
UNIT – V
Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

Suggested Reading:

1.	Kapil Kapoor, '*Text and Interpretation: The India Tradition'*,ISBN: 81246033375, 2005
2.	'*Science in Samskrit*', Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007
3.	NCERT, '*Position paper on Arts, Music, Dance and Theatre'*, ISBN 81-7450 494-X,

	2006
4.	S. Narain, '*Examinations in ancient India'*, Arya Book Depot, 1993
5.	Satya Prakash, '*Founders of Sciences in Ancient India*', Vijay Kumar Publisher, 1989
6.	M. Hiriyanna, '*Essentials of Indian Philosophy*', Motilal BanarsidassPublishers, ISBN 13: 978- 8120810990, 2014

ENGLISH

HS 101 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 2

Objectives: To enhance the English language abilities of Engineering students, especially in reading and writing, by

1. Using authentic material for language learning and Exposing them to a variety of content-rich texts
2. Strengthening their grammar and vocabulary and Improving their reading and comprehension skills
3. Honing their writing skills and Encouraging them to think creatively and critically

Outcomes: On successful completion of the course, the students would be able to

1. Read, understand, and interpret a variety of written texts
2. Use appropriate vocabulary and correct grammar
3. Undertake guided and extended writing with confidence.
4. Develop speaking skills and build upon vocabulary
5. Improve overall language skills of SWRL(Speaking, writing, reading and listening)

UNIT – I
Reading: RK Narayan, "A Horse and Two Goats" ***Vocabulary:*** Word formation—Prefixes, Suffixes, Root Words ***Grammar:*** Articles, Prepositions, Determiners
UNIT – II
Reading: Rudyard Kipling, "If" ***Vocabulary:*** Word formation—Compounding and Blending, Contractions ***Grammar:*** Transitions, Connectives ***Writing:*** Paragraph Writing
UNIT – III
Reading: Martin Luther King Jr., "I Have a dream" ***Vocabulary:*** Synonyms, Antonyms, One Word Substitutes ***Grammar:*** Voice ***Writing:*** Letter Writing
UNIT – IV
Reading: Robert Frost, "Road Not Taken" ***Vocabulary:*** Homophones, Homonyms, Homographs ***Grammar:*** Narration (Direct-Indirect Speech) ***Writing:*** Report Writing
UNIT – V
Reading: George Orwell, "The Sporting Spirit" (Excerpt) ***Vocabulary:*** Inclusive Language, Euphemisms ***Grammar:*** Tense ***Writing:*** SOP

Suggested Reading:

1.	Board of Editors. '*Language and Life: A Skills Approach'*, Orient Black Swan, 2018.
2.	Sudharshana, NP and C Savitha, '*English for Engineers*', Cambridge University Press, 2018.
3.	Kumar, Sanjay and Pushp Lata, '*English Language and Communication Skills for Engineers*', Oxford University Press, 2018.

For the academic years 2020-2024

MATHEMATICS-II

BS 203 MT

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To study matrix algebra and its use in solving system of linear equations and in solving eigen value problems
2. To provide an overview of ordinary differential equations and To study special functions like Legendre and Beta Gamma functions
3. To learn Laplace Transforms and its properties

Outcomes: On successful completion of the course, the students would be able to

1. Solve system of linear equations and eigen value problems
2. Solve certain first order and understand the concept of orthogonality
3. Solve higher order differential equations
4. Solve basic problems of Beta Gamma and Legender's Function.
5. Apply Laplace Transforms; solve ordinary Differential Equations by using it

UNIT – I
Matrices: Rank of a matrix, Echelon form, System of linear equations, Linearly dependence and independence of vectors, Linear transformation, Orthogonal transformation, Eigen values, Eigenvectors, Properties of eigen values, Cayley - Hamilton theorem, Quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation, Nature of quadratic forms.
UNIT – II
Differential Equations of First Order: Exact differential equations, Integrating factors, Linear differential equations, Bernoulli's, Riccati's and Clairaut's differential equations, Orthogonal trajectories of a given family of curves.
UNIT – III
Differential Equations of Higher Orders: Solutions of second and higher order linear homogeneous equations with constants coefficients, Method of reduction of order for the linear homogeneous second order differential equations with variable coefficients, Solutions of non-homogeneous linear differential equations, Method of variation of parameters, solution of Euler-Cauchy equation.
UNIT – IV
Special Function: Gamma Functions, Beta Functions, Relation Between Beta and Gamma Function, Error Functions. Power Series Method, Lengender's Differential Equations and Legender's Polynomial $P_n(x)$, Rodrigue's Formula (without proof).
UNIT – V
Laplace Transforms: Laplace Transforms, Inverse Laplace Transforms, Properties of Laplace Transforms and inverse Laplace Transforms, Convolution Theorem (without proof). Solution of ordinary Differential Equations using Laplace Transforms.

Suggested Reading:

1.	R.K. Jain & S.R.K. lyengar, '*Advanced Engineering Mathematics'*, Narosa Publications, 4th Edition,2014..
2.	Erwin Kreyszig, '*Advanced Engineering Mathematics'*, John Wiley, 9th Edition, 2012.
3.	Dr.B.S. Grewal, '*Higher Engineering Mathematics'*, Khanna Publications, 43rd Edition,2014
4.	B.V. Ramana, '*Higher Engineering Mathematics'*, 23rd reprint, 2015.
5.	N. Bali, M. Goyal, '*A text book of Engineering Mathematics'*, Laxmi publications,2010
6.	H.K. Dass, Er. Rajnish Varma, '*Higher Engineering Mathematics*', Schand Technical Third Edition.

For the academic years 2020-2024

ENGINEERING CHEMISTRY

BS 204 CH

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Correlate the properties of materials with their internal structure and use the for Engineering applications and Apply the principals of electrochemistry in storage of electrical energy in batteries and Gain knowledge in causes of corrosion and its prevention.
2. Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.
3. Exposed to qualitative and quantitative parameters of chemical fuels and Aware eco-friendly materials and processes.

Outcomes: On successful completion of the course, the students would be able to

1. Apply concept of electrode potential in identifying feasibility of electrochemical reaction; illustrate electro analytical techniques and working of batteries.
2. Identify the mechanism of corrosion of materials on basis of electrochemical approach and devise corrosion control methods.
3. Estimate the physical & chemical parameters of quality of water and explain the process of water treatment.
4. Explain the influence of chemical structure on properties of materials and their choice in engineering applications.
5. Classify chemical fuels and grade them through qualitative analysis.
6. Relate the concept of green chemistry to modify engineering processes and materials.

UNIT – I

Electrochemistry and Battery Chemistry: Electrochemistry: Electrochemical cells, Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes, Calomel Quinhydrone and Glass electrodes. Determination of pH of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells, Nernst equation and its derivation. Applications of Nernst equation to electrode potential and emf of cells. Numerical problems.

Batteries: Primary batteries: Zn - Carbon battery. ***Secondary batteries:*** Pb-Acid battery and Li-Ion battery, Applications. ***Flow batteries (Fuel cells):*** Methanol-Oxygen fuel cells, Construction, Applications.

UNIT – II

Water Chemistry and Corrosion: Water Chemistry: Hardness of Water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Numerical problems. Specifications of potable water. Sterilization by Chlorination. Break Point Chlorination.

Corrosion: Causes and its effects. Types of Corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion –Waterline and Pitting Corrosion. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods - Sacrificial anodic and impressed current methods. Surface coating methods: Hot Dipping-Galvanizing.

UNIT – III
Engineering Materials: Polymers: Basics of terms polymers: Monomer and its functionality, Polymers and degree of polymerization. Classification of polymers - Thermoplastics & Thermosetting resins. Types of Polymerization (i) Addition (ii) Condensation (iii) Co-Polymerization. Mechanism of free radical polymerization ***Preparation, Properties & Uses of the following polymers:*** Plastics - PVC and Bakelite, Fibres - Nylon 6:6, and Kevlar, Elastomers - Buna-S, Butyl and Silicone Rubbers. ***Conducting polymers :*** Introduction, Classification and Mechanism of conduction in Poly-acetylene, Applications of conducting polymers. ***Biodegradable polymers:*** Introduction preparation, properties and applications of polylactic acid
UNIT – IV
Chemical Fuels: Classification of fuels: Introduction, definition and classification of chemical fuelsPrimary and secondary fuels. Solid, liquid and gaseous fuels. Requirements of a good fuel. Calorific Value – HCV and LCV. Theoretical calculations of calorific value by Dulong's formula – Numerical problems. ***Solid Fuels:*** Coal and its Ranking. Analysis of coal - Proximate and Ultimate analysis. ***Liquid Fuels:*** Fractionation of Petroleum. Composition and uses of Gasoline, Diesel and Kerosene. Cracking & its Significance- Catalytic cracking by moving bed method, Knocking. Fuel rating – Octane and Cetane numbers. ***Gaseous Fuels:*** LPG, CNG -Composition and Uses. ***Combustion:*** Ignition temperature of a fuel, calculation of air quantities by weight and volume required for combustion of a fuel- Numerical problems.
UNIT – V
Green Chemistry and Composites: Green Chemistry: Concept, Principles of green chemistry – Atom Economy, Catalysis. and examples of clean technology. ***Biodiesel:*** Sources, Concept of Trans esterification and carbon neutrality. Properties and significance ***Composites:*** Introduction to composites, composition and characteristic properties of composites. Classification of composites based on matrix, reinforcement and ply. Applications of composites.

Suggested Reading:

1.	Puri, Sharma and Pathania, '*Principles of Physical Chemistry'*, S.N. Chand & Co. New Delhi (Latest edition).
2.	P C Jain and M Jain, '*Engineering Chemistry'*, Dhanpat Rai & Sons (15th Edn), New Delhi
3.	J C Kuriacose and J Rajaram, '*Chemistry in Engineering and Technology'*, TMH, New Delhi.
4.	O G Palanna, '*Engineering Chemistry'*, TMH, and New Delhi.
5.	S S Dara, '*Engineering Chemistry'*, S Chand & Sons, New Delhi.
6.	Sashi Chawla, '*Engineering Chemistry'*, Dhanpat Rai & Sons, New Delhi.
7.	Shikha Agrawal, '*Engineering Chemistry'*, Cambridge, New Delhi.
8.	Prasanta Rath, '*Engineering Chemistry'*,Cengage Learning India Pvt. Ltd.

PROGRAMMING FOR PROBLEM SOLVING

ES 302 CS

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To introduce the basic concepts of Computing environment, number systems and flowcharts and To familiarize the basic constructs of C language – data types, operators and expressions
2. To understand modular and structured programming constructs in C and To learn the usage of structured data types and memory management using pointers
3. To learn the concepts of data handling using pointers

Outcomes: On successful completion of the course, the students would be able to

1. Formulate simple algorithms for arithmetic and logical problems.
2. Translate the algorithms to programs (in c language).
3. Test and execute the programs and correct syntax and logical errors.
4. Implement conditional branching, iteration and recursion.
5. Decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. Use arrays, pointers and structures to formulate algorithms and programs.
7. Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
8. Apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

UNIT – I
Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). ***Idea of Algorithm:*** steps to solve logical and numerical problems. ***Representation of Algorithm:*** Flowchart / Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code.
UNIT – II
Control Structures: Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching. ***Arrays:*** Arrays (1-D, 2-D), Character arrays and Strings
UNIT – III
Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble and Selection), Finding roots of Equations. Functions: ***Functions*** (including using built in libraries), Parameter passing in functions, call by value. ***Passing arrays to functions:*** idea of call by reference
UNIT – IV
Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series. ***Structure:*** Structures, Defining structures and Array of Structures

UNIT – V
Pointers - Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), ***Introduction to File Handling***.

Suggested Reading:

1.	Byron Gottfried, '*Schaum's Outline of Programming with C'*, McGraw-Hill
2.	A.K. Sharma, '*Computer Fundamentals and Programming in C'*, Universities Press, 2nd Edition, 2018.
3.	E. Balaguruswamy, '*Programming in ANSI C'*, Tata McGraw-Hill
4.	Brian W. Kernighan and Dennis M. Ritchie, '*The C Programming Language'*, Prentice Hall of India.

ENGLISH LAB

HS 151 EG

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives: To enhance the listening and speaking skills of students by

1. Giving them sufficient practice in listening with comprehension and Providing them ample opportunities to improve their public speaking skills
2. Training them in the use of correct pronunciation, stress, and intonation and Sensitizing them to the use of verbal and non-verbal communication appropriate to the context
3. Encouraging them to learn the art of conversation to suit formal and informal situations and Preparing them to make formal presentations and face interviews

Outcomes: On successful completion of the course, the students would be able to

1. Listen, understand, and interpret formal and informal spoken language
2. Speak English with acceptable pronunciation, stress, and intonation
3. Present themselves with confidence in formal situations
4. Participate in individual and group activities with relative ease
5. Improve overall language skills of SWRL(Speaking, writing, reading and listening)

List of Experiments:

1. Listening for Comprehension
2. Pronunciation, Intonation, Stress, and Rhythm
3. Conversation Skills
4. Introducing Oneself and Others
5. Asking for and Giving Information
6. Making Requests and Responding to them Appropriately
7. Giving Instructions and Responding to them Appropriately
8. Making Formal Announcements and Emceeing
9. Group Discussions
10. JAM
11. Role Play
12. Debate
13. Public Speaking Skills and Body Language
14. Interviews
15. Formal Presentations

Suggested Reading:

1. Board of Editors. '*Language and Life: A Skills Approach'*, Orient Black Swan, 2018.
2. Balasubramanian, T. '*A Textbook of English Phonetics for Indian Students'*. Macmillan, 1981.
3. '*CIEFL.Exercises in Spoken English'*, Parts. I-III. Oxford University Press.
4. Pillai, Radhakrishna G. '*Spoken English For You - Level II'*, 8th Edition. Emerald Publishers, 2014.
5. Sethi, J and PV Dhamija. '*A Course in Phonetics and Spoken English'*, 2nd Edition, Prentice Hall India Learning Private Limited, 1999.

ENGINEERING CHEMISTRY LAB

BS 252 CH

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1.5

Objectives:

1. Conduct experiments, take measurements and analyze the data though hands-on experience in order to demonstrate understanding of the theoretical concepts of quantitative Analysis while working in small group.
2. Interpret the electro analytical principles with experimental results graphically
3. Demonstrate writing skills through clear laboratory reports

Outcomes: On successful completion of the course, the students would be able to

1. Apply the principles of Colourimetry and Electrochemistry in quantitative estimations.
2. Estimate the rate constants of reactions from concentration of reactants/ products as a function of time.
3. Synthesize small drug molecules.
4. Perform water analysis and comment on the safety of its usage for household applications
5. Appreciate applications of chemical phenomena to real world problems

List of Experiments:

1. Introduction to Chemical Analysis.
2. Techniques of Weighing.

Volumetric Analysis:

3. Preparation of Standard Mohr's salt solution, Standardization of KMnO4 and estimation ferrous ion.
4. Estimation Iron(II) by Dichromatometry

Water Analysis:

5. Preparation of Standard Magnesium sulphate solution, standardization of EDTA and Estimation of Total Hardness.
6. Preparation of Standard Sodium Carbonate Solution, Standardization of HCl and Estimation of Carbonate and Bicarbonate Alkalinity.

Conductometry:

7. Estimation of HCl
8. Estimation of CH3COOH and mixture of acids

Potentiometry

9. Estimation of HCl
10. Estimation of Iron

pH Metry:

11. Estimation of HCl

Colorimetry:

12. Verification of Beer-Lambert's law and estimation of Manganese.

Chemical Kinetics:

13. Determination of rate constant of acid catalyzed hydrolysis of methyl acetate.

Drug Synthesis

Preparation of Aspirin

Note: Minimum ten experiments should be conducted in the semester

Suggested Readings:

1. B.D. Khosla, A. Gulati and V.Garg, '*Senior Practical Physical Chemistry'*, (R. Chand & Co., Delhi)
2. K. K. Sharma and D.S. Sharma, '*An Introduction to Practical Chemistry'*, (Vikas publishing, N. Delhi)

PROGRAMMING FOR PROBLEM SOLVING LAB

ES 353 CS

Instruction: 4 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 2

Objectives:

1. Understand the fundamentals of programming in C Language.
2. Write, compile and debug programs in C and Formulate solution to problems and implement in C.
3. Effectively choose programming components to solve computing problems

Outcomes: On successful completion of the course, the students would be able to

1. Choose appropriate data type for implementing programs in C language.
2. Design and implement modular programs involving input output operations, decision making and looping constructs.
3. Implement search and sort operations on arrays.
4. Apply the concept of pointers for implementing programs on dynamic memory management and string handling.
5. Design and implement programs to store data in structures and files.

Programming Exercise:

1. Finding maximum and minimum of given set of numbers, finding roots of quadratic equation.
2. Sin x and Cos x values using series expansion.
3. Conversion of binary to decimal, octal, hexadecimal and vice versa.
4. Generating Pascal triangle, pyramid of numbers.
5. Recursion: factorial, Fibonacci, GCD.
6. Matrix addition and multiplication using arrays, linear search and binary search using recursive and non-recursive procedures.
7. Bubble sort and selection sort.
8. Programs on pointers: pointer to arrays, pointer to functions.
9. Functions for string manipulations.
10. Programs on structures and unions.
11. Finding the number of characters, words and lines of given text file.
12. File handling programs

Suggested Readings:

1. Byron Gottfried, '*Schaum's Outline of Programming with C'*, McGraw-Hill
2. A.K. Sharma, '*Computer Fundamentals and Programming in C'*, Universities Press, 2018.
3. E. Balaguruswamy, '*Programming in ANSI C*', Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, '*The C Programming Language'*, Prentice Hall of India.

WORKSHOP / MANUFACTURING PROCESS

ES 352 ME

Instruction: 1+4 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: 50 marks*
Credits : 3

Objectives:

1. Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances and To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
2. To gain a good basic working knowledge required for the production of various engineering products.
3. To Study different hand operated power tools, uses and their demonstration and Adopt safety practices while working with various tools

Outcomes: On successful completion of the course, the students would be able to

1. Demonstrate an understanding of and comply with workshop safety regulations.
2. Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
3. Study and practice on machine tools and their operations
4. Undertake jobs connected with Engineering Workshop trades including fitting, carpentry, sheet metal, house wiring, welding, smithy and foundry.
5. Apply basic electrical engineering knowledge for house wiring practice

A. TRADE FOR EXERCISES:

1. Carpentry
2. Fitting
3. House wiring
4. Sheet metal working
5. Smithy
6. Welding
7. Plumbing

B. TRADES FOR DEMONSTRATION AND EXPOSURE:

1. Machining (Lathe & Drilling)
2. Injection molding
3. Mould making and casting
4. Basic Electronics lab instruments

C. PRESENTATIONS AND VIDEO LECTURES

1. Manufacturing Methods
2. Rapid Prototyping
3. Glass Cutting
4. 3D printing
5. CNC LATHE

D. IT WORKSHOP: Computer hardware, identification of parts, Disassembly, Assembly of computer to working condition, operating system installation.

Suggested Reading:

1. Venugopal, K, '*Workshop manua'*, Anuradha Publications, Kumbakonam, TN, 2012
2. K.C. John, '*Mechanical Workshop'* 2nd Edn., PHI, 2010.
3. Hajra Choudary, '*Elements of Workshop Technology'* Vol. 1, Asian Publishers, Edn., 1993.
4. G.S. Sawhney, '*Mechanical Experiments and Workshop Practice'*, I.K. International Publishing House, New Delhi, 2009.

Note: At least two exercises from each trade.

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/W	CIE	SEE	Duration in Hrs	
Theory Course										
1	HS 102 EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	HS 103 CM	Finance and Accounting	3	-	-	3	30	70	3	3
3	ES 303 EC	Digital Electronics	3	1	-	4	30	70	3	4
4	ES 304 EC	Probability Theory and Stochastic Processes	3	1	-	4	30	70	3	4
5	PC 401 EC	Electronic devices and Circuits	3	-	-	3	30	70	3	3
6	PC 402 EC	Network Theory	3	1	-	4	30	70	3	4
Practical/Laboratory Course										
7	PC 451 EC	Electronic Devices and Circuits Lab	-	-	2	2	25	50	3	1
8	PC 452 EC	Electronic Workshop Lab	-	-	2	2	25	50	3	1
Total			**18**	**3**	**4**	**25**	**230**	**520**	**24**	**23**

PC: Professional Course **HS:** Humanities and Social Sciences **ES:** Engineering Science

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EG: English **CM:** Commerce
EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

For the academic years 2020-2024

EFFECTIVE TECHNICAL COMMUNICATION IN ENGLISH

HS 102 EG

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.Features of technical communication
2.Types of professional correspondence and Techniques of report writing
3.Basics of manual writing and Aspects of data transfer and presentations.

Outcomes: On successful completion of the course, the students would be able to

1.Handle technical communication effectively
2.Use different types of professional correspondence
3.Use various techniques of report writing
4.Acquire adequate skills of manual writing
5.Enhance their skills of information transfer and presentations

UNIT – I
***Definition and Features of Technical communication*:** Definition and features of technical communication (precision, relevance, format, style, use of visual aids), Differences between general writing and technical writing, Types of technical communication (oral and written)
UNIT – II
Technical Writing-I (Official correspondence): Emails, IOM, Business letters, Business proposals.
UNIT – III
Technical writing-II (Reports): Project report, Feasibility report, Progress report, Evaluation report.
UNIT – IV
Technical writing- III (Manuals): Types of manuals, User manual, Product manual, Operations manual.
UNIT – V
Information Transfer and Presentations: Non-verbal (bar diagram, flow chart, pie chart, tree diagram) to verbal (writing), Verbal (written) to non-verbal, Important aspects of oral and visual presentations.

Suggested Reading:

1.	Raman, Meenakshi & Sharma, Sangeeta. (2015). '*Technical Communication: Principles and Practice'*(3rd ed.). New Delhi.
2.	Rizvi,Ashraf, M. (2017) '*Effective Technical Communication'*(2nd ed.).Tata McGraw Hill Education. New Delhi.
3.	Tyagi, Kavita &Misra, Padma. (2011). '*Advanced Technical Communication'*. New Delhi, PHI Learning.

4.	Sharma, R. C., & Mohan, Krishna. (2017). '*Business Correspondence and Report Writing: A Practical Approach to Business & Technical Communication'* (4th ed.). Tata McGraw Hill Education. New Delhi.

For the academic years 2020-2024

FINANCE AND ACCOUNTING

HS 103 CM

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.To provide basic understanding of Financial and Accounting aspects of a business unit
2.To provide understanding of the accounting aspects of business and financial statements
3. To provide inputs necessary to evaluate the viability of projects and the skills necessary to analyse the financial statements

Outcomes: On successful completion of the course, the students would be able to

1. Evaluate the financial performance of the business unit.
2. Take decisions on selection of projects.
3. Take decisions on procurement of finances.
4. Analyse the liquidity, solvency and profitability of the business unit.
5. Evaluate the overall financial functioning of an enterprise.

UNIT – I
***Basics of Accounting*:** Financial Accounting–Definition- Accounting Cycle – Journal - Ledger and Trial Balance-Cash Book-Bank Reconciliation Statement (including Problems)
UNIT – II
Final Accounts: Trading Account-Concept of Gross Profit- Profit and Loss Account-Concept of Net Profit-Balance Sheet (including problems with minor adjustments)
UNIT – III
***Financial System and Markets*:** Financial System-Components-Role-Considerations of the investors and issuers- Role of Financial Intermediaries. Financial Markets-Players- Regulators and instruments - Money Markets Credit Market- Capital Market (Basics only)
UNIT – IV
***Basics of Capital Budgeting techniques*:** Time Value of money- Compounding- Discounting- Future Value of single and multiple flows- Present Value of single and multiple Flows- Present Value of annuities-Financial Appraisal of Projects– Payback Period, ARR- NPV, Benefit Cost Ratio, IRR (simple ratios).
UNIT – V
***Financial statement Analysis*:** Financial Statement Analysis- Importance-Users-Ratio Analysis-liquidity, solvency, turnover and profitability ratios.

Suggested Reading:

1	Satyanarayana. S.V. and Satish. D., '*Finance and Accounting for Engineering'*, Pearson Education
2	Rajasekharan, '*Financial Accounting'*, Pearson Education
3	Sharma.S.K. and Rachan Sareen, '*Financial Management'*, Sultan Chand
4	Jonathan Berk, '*Fundamentals of Corporate Finance'*, Pearson Education
5	Sharan, '*Fundamentals of Financial Management'*, Pearson Education

DIGITAL ELECTRONICS

ES 303 EC

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To learn the principles of digital hardware and support given by it to the software.
2. To explain the operation and design of combinational and arithmetic logic circuits.
3. To design hardware for real world problems

Outcomes: On successful completion of the course, the students would be able to

1.Understand the deign process of digital hardware, use Boolean algebra to minimize the logical expressions and optimize the implementation of logical functions.
2.Understand the number representation and design combinational circuits like adders, MUX etc.
3. Design Combinational circuits using PLDS and write Verilog code for basic gates and combinational circuits.
4. Analyse sequential circuits using flip-flops and design registers, counters.
5.Represent a sequential circuit using Finite State machine and apply state minimization techniques to design a FSM

UNIT – I
Design Concepts: Digital Hardware, Design process, Design of digital hardware. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples. Optimized implementation of logic functions using K-Map and Quine-McCluskey Tabular method
UNIT – II
Number representation: Addition and Subtraction of signed and unsigned numbers. ***Combinational circuit building blocks:*** Adders and Subtractors, Multiplexers. Demultiplexers, Parity Checkers and Generators, Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits. Verilog modeling of simple combination circuits
UNIT – III
Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables(LUTs)
UNIT – IV
Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables. Registers and Counters. Verilog modeling of simple sequential circuits.
UNIT – V
***Synchronous Sequential Circuits*:** Basic Design Steps, Finite State machine(FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.

Suggested Reading:

1	Moris Mano and Michael D CIletti, '*Digital Design'*, Pearson, fourth edition,2008
2	Zvi Kohavi, '*Switching and Finite Automata Theory'*, 3rd ed., Cambridge University Press-New Delhi, 2011.
3	R. P Jain, '*Modern Digital Electronics'*,4th ed., McGraw Hill Education (India) Private Limited, 2003
4	Ronald J.Tocci, Neal S. Widmer &Gregory L.Moss, '*Digital Systems: Principles and Applications*', PHI, 10/e, 2009.
5	Samir Palnitkar, '*Verilog HDL A Guide to Digital Design and Synthesis'*, 2nd Edition, Pearson Education, 2006.

PROBABILITY THEORY AND STOCHASTIC PROCESSES

ES 304 EC

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. To understand fundamentals of probability and Random variables as applicable to Electronic Engg.
2.To learn one Random variable characteristic functions of different variables using their density functions
3.To understand elementary concepts of the Stochastic Processes and their temporal characteristics

Outcomes: On successful completion of the course, the students would be able to

1.To understand different types of Random variables, their density and distribution functions
2.To learn one Random variable characteristic functions of different variables using their density functions
3.To extend the bi-variate distributions and the operations on them.
4.To understand elementary concepts of the Stochastic Processes in the Temporal domain.
5.To analyse the frequency domain information of Stochastic Processes

UNIT – I
***Concepts of Probability and Random Variable*:** Probability introduced through Set Theory and Operations – Definitions and Axioms, Causality versus Randomness, Borel Field, Probability Space – Discrete and Continuous, Events - Definition and independent events, Joint Probability, Conditional Probability, Repeated Trials, Combined Experiments, Bernoulli Trials, Bernoulli's Theorem, Total Probability, Baye's Theorem. **Random Variable:** Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.
UNIT – II
Distribution & Density Functions and Operations on One Random Variable: Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Gamma, Rayleigh and Conditional Distribution, Methods of defining Conditional Event, Conditional Density, Properties.Expected Value of a Random Variable, Function of a Random Variable g(x) and its distribution, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality (no proof), Characteristic Function, Moment Generating Function; Transformations of Random Variables
UNIT – III
Two Random Variables and operations Bi-variate Distributions, One Function of Two Random Variables, Two functions of two random variables, Joint Distribution and Density Function and their properties, Joint Moments, Joint Characteristic Functions, Conditional Distributions (Point & Interval), Conditional Expected Values. Central Limit Theorem (no proof); Engineering application (theoretical discussion) – Mutual information, Channel Capacity and Channel Coding.

UNIT – IV
Stochastic Processes – Temporal Characteristics: Introduction to stationarity (First and Second order; WSS; SSS), statistical independence, Time averages and ergodicity, random processes and independence, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties. Linear System Response of Mean and Mean-squared Value. Introduction to Gaussian and Poisson Random Processes.
UNIT – V
Stochastic Processes – Spectral Characteristics: Power Spectral Density and its properties; Relationship between Power Spectrum and Autocorrelation Function; Relationship between Cross-Power Spectrum and Cross-Correlation Function; White and colored noise, response to linear systems and stochastic inputs, concept of Markov Processes.

Suggested Reading:

1	Henry Stark and John W. Woods, *Probability and Random Processes with Application to Signal Processing'*, 3rd edition, Pearson Education, 2014.
2	Athanasius Papoulis and S. Unnikrishna Pillai, '*Probability, Random Variables and Stochastic Processe's*, 4th edition, McGraw Hill, 2006.
3	Peyton Z. Peebles, '*Probability, Random Variables & Random Signal Principles'*, 4th edition, Tata McGraw Hill, 2001

ELECTRONIC DEVICES AND CIRCUITS

PC 401 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Study semiconductor physics and Analyse the behavior of Semiconductor diodes in Forward and Reverse bias. Develop Half wave and Full wave rectifiers with L, C Filters.
2.Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations and Design DC Biasing techniques, evaluate A.C parameters for BJT in Amplifier Applications
3.Explore V-I characteristics of FETs, MOSFETs and study IC fabrication techniques

Outcomes: On successful completion of the course, the students would be able to

1. Interpret the characteristics and apply diode models to analyse various applications of diodes.
2. Identify the merits and demerits of various filters, formulate and design rectifier circuits with filters Calculate ripple factor, efficiency and percentage regulation of rectifier circuits.
3. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability.
4. Analyse, Compare and design of BJT amplifiers with various biasing circuits.
5.Distinguish the working principles of BJT and FET also between FET & MOSFET

UNIT – I
Basics of Semiconductors*:** Energy bands in intrinsic and extrinsic Silicon. Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers, Poisson and continuity equation, Hall Effect ***Junction Diode: PN Junction formation, Characteristics, biasing–band diagram and current flow, Diode current equation, Breakdown in diodes, Diode as a circuit element, Small signal diode models, Diode switching characteristics, Zener Diode, Zener voltage regulator and its limitation, Schotky diode.
UNIT – II
PN Diode Applications: Half wave, Full wave and Bridge rectifiers–their operation, performance characteristics and analysis. Filters (L, C filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters. ***Special Diodes****:* Elementary treatment on the functioning of Light Emitting diode, Photodiode and Solar cells.
UNIT – III
Bipolar Junction Transistor: Transistor Junction formation (collector-base, base-emitter Junctions), Transistor biasing – band diagram for NPN and PNP transistors, current components and current flow in BJT, Ebers moll model, Modes of transistor operation, BJT V-I characteristics in CB, CE, CC configurations, BJT as an amplifier, BJT biasing techniques, operating point stabilization against temperature and device variations, Bias stabilization and compensation techniques, Biasing circuits design.

UNIT – IV
Small Signal Transistors equivalent circuits: Small signal low frequency h-parameter model of BJT, Approximate model, Analysis of BJT amplifiers using Approximate model for CB, CE and CC configurations; High frequency - Π model, Relationship between hybrid - Π and h – parameter model.
UNIT – V
Junction Field Effect Transistors (JFET): JFET formation, operation & current flow, V-I characteristics of JFET, Low frequency small signal model of FETs, Analysis of CS, CD and CG amplifiers. ***MOSFETs:*** Enhancement & Depletion mode MOSFETs, current equation, V-I characteristics, DC-biasing

Suggested Reading:

1	Jacob Millman, Christos C. Halkias, and Satyabrata Jit, '*Electronic Devices and Circuits'*, 3rd ed., McGraw Hill Education, 2010.
2	G. Streetman and S. K. Banerjee, '*Solid State Electronic Devices'*, 7th edition, Pearson, 2014.
3	S. M. Sze and K. N. Kwok, '*Physics of Semiconductor Devices'*, 3rd edition, John Wiley& Sons, 2006.
4	D. Neamen, D. Biswas, '*Semiconductor Physics and Devices'*, McGraw-Hill Education.
5	Robert Boylestad and Louis Nashelsky, '*Electronic Devices and Circuit Theory'*, 11th ed., Pearson India Publications, 2015.

NETWORK THEORY

PC 402 EC

Instruction: 3+1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. Concepts of Two Port networks, study about the different two port parameter representations.
2. Concepts about the image impedance on different networks, design of attenuators.
3. Design concepts of equalizers, different filters, network synthesis

Outcomes: On successful completion of the course, the students would be able to

1.Able to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications.
2. Able to learn how to calculate properties of networks and design of attenuators.
3. Able to design of equalizers.
4. Able to design different types of filters using passive elements.
5. Able to synthesize the RL & RC networks in Foster and Cauer Forms..

UNIT – I
Two Port networks: Z, Y, h, g and ABCD parameters, equivalence of two ports networks, T-π transforms, Reciprocity theorem, Interconnection of two port networks and Brune's test for inter connections.
UNIT – II
Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant of symmetrical T and π networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and π networks.
UNIT – III
Constant k- Filters- Low pass, high pass, band pass and band elimination filter design, m-derived low pass and high pass filter design, Composite filter design and notch filter.
UNIT – IV
Attenuators and Equalizers- Design of symmetrical T, π , Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks, Equalizers, Constant resistance equalizer, full series and full shunt equalizer**.**
UNIT – V
Network Synthesis: Hurwitz polynomials, positive real functions, Basic Philosophy of Synthesis, L-C Immitance functions, RC impedance functions and RL admittance functions. RL impedance functions and RC admittance functions. Cauer and Foster's forms of RL impedance and RC admittance. Properties of RC, RL Networks**.**

Suggested Reading:

1	Ryder J.D, '*Network Lines Fields'*, 2nd edition, Prentice Hall of India,1991.
2	P.K. Jain and Gurbir Kau, '*Networks, Filters and Transmission Lines'*, Tata McGraw-Hill Publishing Company Limited.
3	A. Sudhakar Shyammohan, '*Circuits Networks: Analysis Synthesis'*, 4th edition, Tata McGraw-Hill, 2010.
4	Van Valkenburg M.E, '*Introduction to Modern Network Synthesis'*, Wiley Eastern 1994.
5	S.P. Ghosh and A.K. Chakraborty, '*Network Analysis and Synthesis'*, McGraw Hill, 1st edition, 2009.

ELECTRONIC DEVICES LAB

PC 451 EC

Instruction:2 periods per week *Duration of SEE:3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.Study the characteristics of PN diode
2.Learn the characteristics of BJT in CE, CB and CC configurations and Plot the characteristics of FET in CS and CD configurations
3.Observe the parameters of BJT and FET amplifiers and Design biasing circuits

Outcomes: On successful completion of the course, the students would be able to

1.Understand characteristics of Diodes
2. Plot the characteristics of BJT in different configurations.
3. Record the parameters of BJT and FET amplifiers.
4. Understand biasing techniques of BJT.
5. Use the SPICE software for simulating electronic circuits.

List of Experiments

1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances.
2. Zener diode Characteristics and its application as voltage regulator.
3. Design, realization and performance evaluation of half wave rectifiers without and with filters.
4. Design, realization and performance evaluation of full wave rectifiers without and with filters.
5. V-I Characteristics of BJT in CB configuration.
6. V-I Characteristics of BJT in CE configuration.
7. V-I Characteristics of JFET in CS configuration.
8. Frequency response of Common Emitter BJT amplifier.
9. Frequency response of Common Source FET amplifier.
10. BJT Biasing circuit design.
11. V-I characteristics of UJT
12. Simulate any four experiments using PSPICE

Note: A minimum of 10 experiments should be performed

Suggested Reading:

1	Paul B. Zbar, Albert P. Malvino, *Micheal A. Miller, 'Basic Electronics, A text – Lab Manual'*, 7th Edition, TMH 2001.

ELECTRONIC WORKSHOP LAB

PC 452 EC

Instruction:2 periods per week *Duration of SEE:3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.To learn the usage of basic electronic components, equipment and meters used in electronic Laboratories and To learn practical electric AC and DC circuits
2.Verify the truth tables of combinational and sequential circuits
3.Realize combinational and sequential circuits and Design adder / subtractor

Outcomes: On successful completion of the course, the students would be able to

1.Use the basic electronic components and design circuits.
2.Verify various parameters of the circuits by applying theorems.
3.Understand the pin configuration of ICs and verify the operation of basic gates
4.Design and verify the combinational and logic circuits.
5. Use the SPICE software for simulating circuits.

List of Experiments

Part A

1. Study of all types of discrete Active & passive devices, display devices, integrated components, electro mechanical components (switches, sockets, connectors etc.,) electromagnetic components (relays). Study and use of different meters (volt/ammeter, AVO/Multi meter) for the measurement of electrical parameters. Measurement of RLC components using LCR Meter.
2. Soldering and Desoldering
3. PCB design and circuit assembling
4. Study of CRO and its applications.
5. Design and Verification of Superposition and Tellegan's theorem
6. Design and Verification of Thevenin's and Maximum Power Transfer Theorem.
7. Measurement of two-port network parameters.
8. Measurement of Image impedance and Characteristics impedance.

Part B

Implement using digital ICs

9. Verification of truth tables of Logic gates and realization of Binary to Gray and Gray to Binary code converters.

10. Realization of Half adder/sub and full adder/sub using universal logic gates.
11. Realization of Full adder/Sub using MUX and Decoder
12. Design 2's complement Adder/subtractor using IC 74283 and verify experimentally.
13. Verification of truth tables of Flip Flops and Flip flop conversions form one form to the other.

Note: A minimum of 6 experiments in Part-A and 4 experiments in Part-B should be performed. The students may use any commercial / open source SPICE programs available like MULTISIM, PSPICE, TINA, LAB VIEW for simulation.

Suggested Reading:

1	Paul B. Zbar, Albert P. Malvino, *Michael A. Miller, 'Basic Electronics, A Text – Lab Manual'*, 7thEdition, TMH 2001.
2	Paul Tobin, '*PSPICE for Circuit Theory and Electronic Devices'*, Morgan & Claypool publishers, 1st ed., 2007.
3	Charles H. Roth,'*Fundamentals of Logic Design'*- Cengage Learning, 5th, Edition, 2004.

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES 305 EC	Signals and Systems	3	1	-	4	30	70	3	4
2	PC 403 EC	Analog Electronic Circuits	3	-	-	3	30	70	3	3
3	PC 404 EC	Computer Organisation and Architecture	3	-	-	3	30	70	3	3
4	PC 405 EC	Electromagnetic Wave Theory and Transmission Line	3	-	-	3	30	70	3	3
5	PC 406 EC	Pulse and Linear Integrated Circuits	3	-	-	3	30	70	3	3
6	PC 407 EC	Electronic Measurements and Instrumentation	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	PC 453 EC	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
8	PC 454 EC	Pulse and Linear Integrated Circuits Lab	-	-	2	2	25	50	3	1
Total			**18**	**1**	**4**	**23**	**230**	**520**	**24**	**21**

PC: Professional Course **ES:** Engineering Science

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

For the academic years 2020-2024

SIGNALS AND SYSTEMS

ES 305 EC

Instruction: 3+ 1 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :4

Objectives:

1. Analyze basic concepts related to continuous time signals and systems, mathematical representation of periodic signals. Familiarize with basic operations on signals and mathematical representation of a periodic signals using Fourier and Laplace transform.
2. Analyze basic concepts related to discrete time signals and systems, mathematical representation discrete time signals.
3. Describe the concept of Z- Transform and its properties and illustrate their applications to analyze systems. Define convolution, correlation operations on continuous and discrete time signals

Outcomes: On successful completion of the course, the students would be able to

1. Define and differentiate types of signals and systems in continuous and discrete time
2. Apply the properties of Fourier transform for continuous time signals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs.
4. Apply Z-transforms for discrete time signals to solve Difference equations.
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

UNIT – I
Definitions and classifications: Classification of signals. Elementary continuous time signals, Basic operations on continuous-time signals. ***classification of continuous-time systems:*** continuous time & discrete time systems, lumped-parameter & distributed –parameter systems, static & dynamic systems, causal & non-causal systems, Time-invariant & time-variant systems, stable & unstable systems
UNIT – II
Representation of Continuous-time signals: Analogy between vectors and signals, orthogonality and completeness. ***Fourier series Analysis of Continuous-time signals*:** Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, complex Fourier spectrum.
UNIT – III
Continuous-time Fourier Transform (FT)*:* The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals , properties of FT, The Frequency Spectrum. ***Linear Convolution of continuous time signals***: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation. ***Laplace Transform (LT) Analysis of signals and systems*:** The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function.

UNIT – IV
Discrete-time signals and systems*:* Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems. ***Linear Convolution of discrete time signals*****:** Graphical interpretation, properties of discrete convolution ***Fourier analysis of discrete-time signals:*** Discrete-time Fourier transform (DTFT), properties of DTFT, Transfer function, Discrete Fourier transform properties of DFT
UNIT – V
Z-Transform analysis of signals & systems**:** The direct Z transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z transform, Properties of Z-transforms. Solution to linear difference equations, Linear constant coefficient systems, System transfer function.

Suggested Reading:

1	B. P. Lathi, '*Linear Systems and Signals'*, Oxford University Press, 2nd Edition, 2009
2	Alan V O P Penheim, A. S. Wlisky, '*Signals and Systems'*, 2nd Edition, Prentice Hall
3	Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, '*Signals and Systems'*, 4th Edition, Pearson 1998.
4	Douglas K. Linder, '*Introduction to Signals and Systems'*, McGraw Hill, 1999
5	P. Ramesh babu, R Ananada Natarajan, '*Signals and Systems'*, SCITECH, 3rd edition 2009..

For the academic years 2020-2024

ANALOG ELECTRONIC CIRCUITS

PC 403 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits :3

Objectives:

1.Analyse frequency response of Amplifiers in different frequency ranges and Familiarize with concept and effect of negative feedback
2.Study positive feedback and Design different types of oscillators
3.Design Power Amplifiers and calculate their efficiencies and Familiarize with concept of tuned Amplifiers

Outcomes: On successful completion of the course, the students would be able to

1.Design and Analyse low frequency, mid frequency and high frequency response of small signal Single stage and Multistage RC coupled and Transformer Amplifiers using BJT and FET.
2. Identify the type of negative feedback, Analyse and design of negative feedback amplifiers.
3.Design Audio Frequency and Radio Frequency oscillators
4.Distinguish between the classes of Power Amplifiers and their design considerations
5. Compare the performance of single and double tuned amplifiers

UNIT – I
Small Signal Amplifiers: Classification of amplifiers, mid-frequency, Low-frequency and high frequency analysis of single and multistage RC coupled amplifier with BJT and FET. Analysis of transformer coupled amplifier in mid frequency, Low frequency and high frequency regions with BJT.
UNIT – II
Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, Voltage and current, series and shunt feedbacks. Stability considerations, Local Versus global feedback
UNIT – III
Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator. ***Regulators***: Transistorized series and shunt regulators
UNIT – IV
Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push-pull audio power amplifiers under Class-A. Class-B, Class D and Class-AB operations
UNIT – V
***RF Voltage Amplifiers*:** General consideration, Analysis and design of single tuned and double tuned amplifiers with BJT, Selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization & uni-laterisation, introduction to staggered tuned amplifiers.

Suggested Reading:

1	Jacob Millman, Christos C. Halkias, and Satyabrata Jit, '*Electronic Devices and Circuits*', 3rd ed., McGraw Hill Education, 2010.
2	David A. Bell, '*Electronic Devices and Circuits'*, 5th ed., Oxford University Press, 2009.
3	S Salivahanan, N Kumar, and A Vallavaraj, '*Electronic Devices and Circuits'*, 2nd ed., McGraw Hill Education, 2007.
4	Jacob Millman, Christos Halkias, Chetan Parikh, '*Integrated Electronics'*, 2nd ed., McGraw Hill Education (India) Private Limited, 2011.
5	Donald L Schilling & Charles Belove, '*Electronics Circuits, Discrete & Integrated'*, 3rd ed., McGraw Hill Education (India) Private Limited, 2002

COMPUTER ORGANIZATION AND ARCHITECTURE

PC 404 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Implement the fixed-point and floating-point addition, subtraction, multiplication & Division.
2. Describe the basic structure and operation of a digital computer and Discuss the different ways of communicating with I/O devices and standard I/O interfaces
3. Analyze the hierarchical memory system including cache memories and virtual memory. Understand issues affecting modern processors.

Outcomes: On successful completion of the course, the students would be able to

1. Perform mathematical operations on fixed and floating point digital data.
2. Illustrate the operation of a digital computer.
3. Understand I/O interfacing of a computer.
4. Interface microprocessor with memory devices.
5 Understand latest trends in microprocessors..

UNIT – I
***Data representation and Computer arithmetic*:** Introduction to Computer Systems, Organization and architecture, evolution and computer generations; 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 and its arithmetic operations.
UNIT – II
***Basic Computer organization and Design*:** Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control organization, address sequencing, micro instruction format and micro program sequencer.
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. Pipeline and vector Processing, Parallel Processing, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors
UNIT – IV
***Input-output Organization*:** I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP communication, I/O channel.

UNIT – V
Memory Organization: Memory hierarchy, Primary memory, Auxiliary memory, Associative memory,Cache memory: mapping functions, Virtual memory: address mapping using pages, Memory management.

Suggested Reading:

1	Morris Mano, M., '*Computer System Architecture'*, 3/e, Pearson Education, 2005.
2	William Stallings, '*Computer Organization and Architecture: Designing for performance*', 7/e, Pearson Education, 2006.
3	John P. Hayes, '*Computer Architecture and Organization'*, 3/e, TMH, 1998.
4	Govindarajalu, '*Computer Architecture and Organization'*, TMH.
5	Hebbar, '*Computer Architecture'*, Macmillan,2008.

ELECTROMAGNETIC THEORY AND TRANSMISSION LINES

PC 405 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.Analyse fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe the relationship between Electromagnetic Theory and circuit theory. Formulate the basic laws of static electricity and magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integral form.
2.Derive the wave equations for conducting and di-electric mediums to analyse the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences and Analyse fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines & applications.
3.To understand the concepts of RF Lines and their characteristics, Smith Chart and its applications, acquire knowledge to configure circuit elements, QWTs and HWTs and to apply the same for practical problems

Outcomes: On successful completion of the course, the students would be able to

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magneto-statics concepts and laws such as Biot-Savarts law and Amperes law, their application in finding magnetic field intensity, inductance and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for different lines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems

UNIT – I
***Electrostatics*:** Review of coordinate systems. Coulomb's Law, Electric field due to various Charge distributions and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations
UNIT – II
***Magnetostatics*:** Steady magnetic - Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

UNIT – III
Electromagnetic Waves: Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Power, Poynting theorem, Surface Impedence. ***Reflection and Refraction*****:** Normal and Oblique incidence on dielectric and conducting medium. ***Regulators***: Transistorized series and shunt regulators
UNIT – IV
Transmission Lines 1: Overview of T and π networks. Two wire Transmission lines, Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance- Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.
UNIT – V
Transmission Lines 2: Impedance of a transmission line, RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications

Suggested Reading:

1	Matthew N.O. Sadiku, '*Principles of Electro-magnetics'*, 6th edition, Oxford University Press, 2016.
2	William H. Hayt Jr. and John A. Buck, '*Engineering Electromagnetics'*, h edition, Tata McGraw Hill, 2006.
3	John D. Ryder, '*Networks Lines and Fields'*, 2nd edition, Pearson, 2015.
4	E.C. Jordan and K.G. Balmain, '*Electromagnetic Waves and Radiating Systems'*, 2nd edition, Pearson, 2015
5	K.D. Prasad, '*Antennas and Wave Propagation'*, Khanna Publications

PULSE AND LINEAR INTEGRATED CIRCUITS

PC 406 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Analyse the behaviour of Linear and non-linear wave shaping circuits
2. Analyse and design of Multivibrators
3. Understand the functionality of OP-AMP, 555 timer and PLL with applications to Data convertors

Outcomes: On successful completion of the course, the students would be able to

1. Construct different linear networks and analyse their response to different input signals
2. Understand, Analyse and design multi vibrators and sweep circuits using transistors.
3. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters
4. Analyse DC and AC characteristics for Single/Dual input Balanced/Unbalanced output configurations using BJTs.
5. Distinguish various linear and non-linear applications of Op-Amp. Analyse the operation of the most commonly used D/A and A/D converter types.

UNIT – I
Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe. **Non-Linear Wave Shaping:** Diode clippers, Transistor clippers, clipping at two independent levels, Comparators, applications of voltage comparators. Clamping operation, clamping circuit taking Source and Diode resistances into account, Clamping circuit theorem.
UNIT – II
Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using transistors, **Time Base Generators:** General features of a time base signal, methods of generating voltage time base waveform.
UNIT – III
Differential amplifiers: Classification, DC and AC Analysis of Single/Dual input Balanced and Unbalanced output configurations using BJTs. Level Translator. **Operational Amplifier**: OP AMP Block diagram, ideal Opamp characteristics, Opamp and its features, Opamp parameters and Measurements, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and Compensation Techniques.
UNIT – IV
OPAMP Applications: Inverting and Non-Inverting Amplifiers, Integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop. Log and Anti Log Amplifiers.

UNIT – V
555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger Applications. Fixed and variable voltage regulators, PLL and its Applications. **Data Converters**: Digital-to-analog converters (DAC): Weighted resistor, inverted R-2R ladder, Analog-to-digital converters (ADC): dual slope, successive approximation, flash, Specifications.

Suggested Reading:

1	J. Millman and H. Taub, '*Pulse, Digital and Switching Waveforms'* - McGraw-Hill, 1991
2	David A. Bell, '*Solid State Pulse circuits'* - PHI, 4th Edn., 2002.
3	Ramakanth A. Gayakwad, '*Op-Amps and Linear Integrated Circuits'* Pearson,2018, 4th edition
4	D.Roy Chowdhury, Shail B.Jain, '*Linear Integrated Circuits'*, 4/e, New Age International (P) Ltd., 2008.

For the academic years 2020-2024

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

PC 407 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Understand the different standards of measurements.
2. Study different types of transducers, Sensors and their measuring techniques
3. Learn about various types of biomedical instrumentation equipment.

Outcomes: On successful completion of the course, the students would be able to

1. Describe characteristic of an instrument and state different Standards of measurements
2. Identify and explain different types of Transducers
3. Draw and Interpret types of transducers.
4. Design and analyse the digital voltmeters and Prioritize the instruments.
5. Identify and classify types of Biomedical instruments.

UNIT – I
Electronic Measurement fundamentals: Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.
UNIT – II
Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, acceleration. Passive electrical transducers- Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers
UNIT – III
Electronic Sensors: Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermo couples
UNIT – IV
Measuring instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analysers. The IEEE488 or GPIB Interface and protocol. Delayed time base oscilloscope and Digital storage oscilloscope. Introduction to virtual instrumentation, SCADA. Data acquisition system block diagram
UNIT – V
Biomedical Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders – ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems

Suggested Reading:

1	J. Millman and H. Taub, '*Pulse, Digital and Switching Waveforms'* - McGraw-Hill, 1991
2	David A. Bell, '*Solid State Pulse circuits'* - PHI, 4th Edn., 2002.
3	Ramakanth A. Gayakwad, '*Op-Amps and Linear Integrated Circuits'* Pearson,2018, 4th edition
4	D.Roy Chowdhury, Shail B.Jain, '*Linear Integrated Circuits'*, 4/e, New Age International (P) Ltd., 2008.

ANALOG ELECTRONIC CIRCUIT LAB

PC 453 EC

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.Design and analyse BJT, FET amplifiers, multivibrators
2.Analyse Oscillator circuits
3.Understand Op-Amp. Applications and filter circuits

Outcomes: On successful completion of the course, the students would be able to

1.Calculate gain and bandwidth of BJT, FET
2.Study multivibrator circuits
3. Study oscillator circuits.
4.Demonstrate filter circuits
5. Demonstrate power amplifier and Op-Amp. Circuits

List of Experiments

1. Two Stage RC Coupled CE BJT amplifier.
2. Two Stage RC Coupled CS FET amplifier.
3. Voltage Series Feedback Amplifier.
4. Voltage Shunt Feedback Amplifier.
5. Current series feedback Amplifier
6. RC Phase Shift Oscillator.
7. Hartley & Colpitt Oscillators
8. Design of Class A and Class B Power amplifiers.
9. Constant-k low pass & high pass filters.
10. m-Derived low pass & high pass filters.
11. Series and Shunt Voltage Regulators
12. RF Tuned Amplifier

SPICE:

13. Two Stage RC Coupled CS FET amplifier.
14. Voltage Series Feedback Amplifier
15. Current Shunt Feedback Amplifier

Note: A minimum of 10 experiments should be performed. It is mandatory to simulate any three experiments using SPICE.

Suggested Reading:

1	Paul B. Zbar, Albert P. Malvino, *Micheal A. 'Miller, Basic Electronics, A text–Lab Manual'*, 7th Edition, TMH 2001

PULSE AND LINEAR INTEGRATED CIRCUITS LAB

PC 454 EC

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.To implement high pass and low pass circuit, clipping and clamping circuits and study it`s performance
2.To design and test bi-stable, mono-stable multi-vibrators
3.To study the characteristics of a Schmitt trigger and to build sweep circuits and study it`s performance

Outcomes: On successful completion of the course, the students would be able to

1. Design and analyse linear and non-linear wave shaping circuits.
2. Design and analyse clipping and clamping circuits.
3. Design and analyse multivibrator circuits.
4.Design and analyse Schmitt trigger circuit
5.Verify the characterstics of TTL & CMOS circuits

List of Experiments

1. Low Pass and High Pass RC Circuits
2. Two level Clipping Circuit
3. Clamping Circuit
4. Transistor Switching Times
5. Collector Coupled Bistable Multivibrators
6. Collector Coupled Monstable Multivibrators
7. Collector Coupled Astable Multivibrators
8. Schmitt Trigger Circuit
9. Measurement of OPAMP Parameters
10. Inverting and Non-inverting OPAMP Voltage follower
11. Integrator and Differentiator using OPAMP
12. Active filters
13. Astable and Mono stable multi vibrator using NE555 IC
14. Astable and Monostable multivibrator using OPAMP
15. Miller Sweep Circuit
16. UJT Relaxation Oscillator

Note: A minimum of 10 experiments should be performed

Suggested Reading:

1	Robert Boylestad and Louis Nashelsky, 'Electronic Devices and Circuit *Theory'*, 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995.
2	David A. Bell, Laboratory Manual for '*Electronic Devices and Circuits'*, 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. V- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PC 408 EC	Digital Signal Processing	3	-	-	3	30	70	3	3
2	PC 409 EC	Microprocessors & Microcontrollers	3	-	-	3	30	70	3	3
3	PC 410 EC	Analog Communication	3	-	-	3	30	70	3	3
4	PC 411 EC	Automatic Control Systems	3	-	-	3	30	70	3	3
5	PC 412 EC	Antenna and wave Propagation	3	-	-	3	30	70	3	3
6	HS 104 ME	Industrial Administration And Financial Management	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	PC 455 EC	Microprocessor and Microcontroller Lab	-	-	2	2	25	50	2	1
8	PC 456 EC	Systems and Signal Processing Lab	-	-	2	2	25	50	2	1
9	PC 457 EC	Mini Project	-	-	2	2	50	-	-	1
Total			**18**	**-**	**6**	**24**	**280**	**520**	**22**	**21**

PC: Professional Course **HS:** Humanities and Social Sciences

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EC: Electronics and Communication Engineering
ME: Mechanical Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

For the academic years 2020-2024

DIGITAL SIGNAL PROCESSING

PC 408 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Describe the necessity and efficiency of digital signal processing
2. Design and implementation of FIR and IIR digital filters
3. Describe the basics of Multirate digital signal processing and its application and Describe the DSP processor architecture for the efficient implementation of digital filters

Outcomes: On successful completion of the course, the students would be able to

1. Necessity and use of digital signal processing and its application
2. Analyze and design IIR digital filters
3. Analyze and design FIR digital filters
4. Applications of Multirate digital signal processing
5. Understand DSP processor and its architecture

UNIT – I
Discrete Fourier Transform and Fast Fourier Transform: Discrete Fourier Transform (DFT), Computation of DFT- Linear and Circular Convolution, FFT algorithms: Radix-2 case, Decimation in Time and Decimation in Frequency algorithms- in place computation- bit reversal.
UNIT – II
Infinite Impulse- response Filters (IIR): Introduction to filters, comparison between practical and theoretical filters, Butterworth and ChebyShev approximation, IIR digital filter design techniques- Impulse Invariant technique- Bilinear transformation technique, Digital Butterworth & Chebyshev filters. Implementation.
UNIT – III
Finite impulse-response Filters (FIR) : Linear phase filters, Windowing techniques for design of Linear phase FIR filters- Rectangular, triangular, Bartlett, Hamming, Hanning, Kaiser windows, Realization of filters, Finite word length effects, Comparison between FIR and IIR.
UNIT – IV
Multirate Digital Signal Processing: Introduction- Decimation by factor D and interpolation by a factor I- Sampling Rate conversion by a Rational factor I/D- ***Implementation of Sampling Rate conversion-*** Multistage implementation of Sampling Rate conversion- Sampling conversion by a Arbitrary factor, Application of Multirate Signal Processing.
UNIT – V
Introduction to DSP Processors: Difference between DSP and other microprocessors architecture- their comparison and need for ASP, RISC and CPU- General Purpose DSP processors:TMS320C67XX processors, architecture, addressing modes- instruction set.

Suggested Reading:

1	Alan V. Oppenheim and Ronald W. Schafer, *'Digital Signal Processing*', 2/e, PHI, 2010.
2	John G. Praokis and Dimtris G. Manolakis, '*Digital Signal Processing: Principles, Algorithms and Application*', 4/e, PHI, 2007..
3	Avathar Singh and S. Srinivasan,'*Digital Signal Processing using DSP Microprocessor*', 2/e, Thomson Books, 2004.
4	John G Proakis and Vinay K Ingle, 'D*igital Signal Processing using MATLAB'* 3/e, Cengage Learning, 1997
5	Richard G Lyons, '*Understanding Digital Signal Processing*', 3/e, Prentice Hall.

For the academic years 2020-2024

MICROPROCESSOR AND MICROCONTROLLER

PC 409 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits:3

Objectives:

1	Understand architecture & programming of 8086 microprocessor and 8051 microcontrollers
2	Design Interfacing of memory , 8255,8257 and 8251 to 8086 processor and Differentiate of 8086 and 8051 in terms of internal architecture, memory, Programming
3	Design Interfacing & Programming of I/O ports, timers and UART using 8051 and Design Interfacing of real time devices like ADC, DAC and stepper motor with 8051

Outcomes: On successful completion of the course, the students would be able to

1.	Explain the architecture of 8086 microprocessor and recognize different types of addressing modes.
2.	Write assembly language programming using 8086 microprocessor instruction set.
3.	Interface different peripherals to 8086 microprocessor
4.	Explain the architecture of 8051 architecture and write Assembly/C language programming using 8051 microcontroller
5.	Interface different peripherals to 8051 microcontroller.

UNIT – I
8086 Microprocessor:
Intel 8086/8088 architecture, Segmented memory, Minimum and Maximum modes of operation, Timing diagram, addressing modes, Instruction set, assembly language programming using data transfer, arithmetic, logical and branching instructions.
UNIT – II
8086 Programming and Interfacing:
Assembler directives, macros, procedures, assembly language programming using string manipulation instructions, 8086 Interrupt structure, IO and Memory Interfacing concepts using 8086, IC Chip Peripherals-8255 PPI, 8257 DMA controller, 8251 USART..
UNIT – III
8051 Microcontroller – Internal architecture and pin configuration, 8051 addressing modes, instruction set, Bit addressable features. I/O Port structures, assembly language programming using data transfer, arithmetic, logical and branch instructions .
UNIT – IV
8051 Timers and Interrupts:
8051 Timers/Counters, Serial data communication and its programming, 8051 interrupts, Interrupt vector table, Interrupt programming.
UNIT – V
8051 Interfacing: Interfacing of 8051 with LCD, ADC, DAC, external memory, Stepper Motor interfacing.

Suggested Reading:

1	Ray A.K & Bhurchandhi K.M, '*Advanced Microprocessor and Peripherals*', 2/e, TMH, 2007.
2	Mazidi M.A, Mazidi J.G &Rolin D. Mckinlay, '*The 8051 Microcontroller & Embedded Systems using Assembly and C*', 2/e, Pearson Education, 2007.
3	Ayala K.J, '*The 8051 Micro Controller Architecture, programming and Application'*, Penram International, 2007
4	Scott MacKenzie and Raphael C.W.Phan. '*The 8051 Microcontroller'*.(4/e), Pearson education, 2008
5	Douglas V.Hall, '*Microprocessors and Interfacing Programming and Hardware'*, 2nd Edition, Tata McGraw- Hill publishing company Limited, New Delhi, 1994.

ANALOG COMMUNICATION

PC 410 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To analyze the analog communication system requirements
2	To understand the generation & detection of various analog modulation techniques and To analyze the noise performance of analog modulation techniques
3	To understand AM and FM receivers and To understand the pulse modulation techniques

Outcomes: On successful completion of the course, the students would be able to

1. Understand analog communication system
2. Compare and analyze analog modulation techniques
3. Calculate noise performance of analog modulation techniques
4. Design AM and FM receivers
5. Differentiate between pulse modulation techniques & continuous modulation techniques.

UNIT – I
Amplitude Modulation: Need for modulation, Amplitude Modulation (AM). Double side band suppressed carrier (DSB –SC) modulation, Hilbert transform, properties of Hilbert transform. Pre-envelop. Complex envelope representation of band pass signals, In-phase and Quadrature component representation of band pass signals. Low pass representation of band pass systems. Single side band (SSB) modulation and Vestigial-sideband (VSB) modulation Modulation and demodulation of all the modulation schemes, COSTAS Receiver.
UNIT – II
Angle modulation: Frequency Modulation (FM) and Phase modulation (PM), Concept of instantaneous phase and frequency. Types of FM modulation: Narrow band FM and wide band FM. FM spectrum in terms of Bessel functions. Direct and Indirect (Armstrong's) methods of FM Generation Balanced discriminator, Foster–Seeley Discriminator, Zero crossing detector and Ratio detector for FM demodulation Amplitude Limiter in FM.
UNIT – III
Transmitters and Receivers: Classification of transmitters. High level and low level AM transmitters FM transmitters Principle of operation of Tuned radio frequency (TRF) and super heterodyne receivers Selection of RF amplifier Choice of Intermediate frequency Image frequency and its rejection ratio Receiver characteristics: Sensitivity, Selectivity, Fidelity, Double spotting, Automatic Gain Control.
UNIT – IV
Analog pulse modulation: Sampling of continuous time signals. Sampling of low pass and band pass signals Types of sampling Pulse Amplitude Modulation (PAM) generation and demodulation. Pulse time modulation schemes: PWM and PPM generation and detection. Time Division Multiplexing.
UNIT – V
Noise: Atmospheric noise, Shot noise and thermal noise. Noise temperature Noise in two-port network: noise figure, equivalent noise temperature and noise bandwidth. Noise figure and

equivalent noise temperature of cascade stages. Narrow band noise representation S/N ratio and Figure of merit calculations in AM, DSB-SC, SSB and FM systems, Pre-Emphasis and De-Emphasis.

Suggested Reading:

1	Simon Haykin, '*Communication Systems*', 2/e, Wiley India, 2011.
2	B.P. Lathi, Zhi Ding, '*Modern Digital and Analog Communication Systems*', 4/e, Oxford University Press, 2016.
3	P. Ramakrishna Rao, '*Analog Communication*', 1/e, TMH, 2011
4	T G Thomas and S Chandra Shekar, '*Communication theory'*, 2/e, McGraw-Hill Education
5	R. P. Singh, S. D. Sapre, '*Communication Systems'*,2/e McGraw-Hill Education, 2008

For the academic years 2020-2024

AUTOMATIC CONTROL SYSTEMS

PC 411 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To Analyze the stability and performance of dynamic systems in both time and frequency domain
2	To design feedback controllers, such as PID, lead and lag compensators, to meet desired system performance specifications and To provide knowledge of state variable models and fundamental notions of state model design
3	To understand the classical methods of control engineering and physical system modeling by linear differential equations and To understand state space representation of control systems

Outcomes: On successful completion of the course, the students would be able to

1. Convert a given control system into equivalent block diagram and transfer function
2. Analyze system stability using time domain techniques
3. Analyze system stability using frequency domain techniques
4. Design a digital control system in the discrete time domain
5. Analyze a control system in the state space representation.

UNIT – I
Control System fundamentals and Components: Classification of control systems including Open and Closed loop systems, Transfer function representation, Mathematical modeling of Mechanical systems and their conversion into electrical systems, Block diagram representation, Block diagram algebra and reduction and Signal flow graphs and Mason's gain formula.
UNIT – II
Time Response: Transfer function and types of input. Transient response of second order system for step input. Time domain specifications Characteristic Equation of Feedback control systems Types of systems, static error coefficients, error series, ***Stability:*** Concept of Stability, Routh-Hurwitz criterion for stability, Root locus technique and its construction
UNIT – III
Frequency response plots: Bode plots, frequency domain specifications Gain and Phase margin. Principle of argument Nyquist plot and Nyquist criterion for stability ***Compensation Techniques:*** Cascade and feedback compensation. Phase lag, lead and lag-lead compensators PID controller
UNIT – IV
Discrete Control Systems: Digital control, advantages and disadvantages, Digital control system architecture. The discrete transfer function sampled data system Transfer function of sample data systems. Analysis of Discrete data systems.
UNIT – V
State space representation: Concept of state and state variables. State models of linear time invariant systems, State transition matrix, Solution of state equations. Controllability and Observability.

Suggested Reading:

1	Nagrath, I.J, and Gopal, M., '*Control System Engineering*', 5/e, New Age Publishers, 2009
2	NagoorKani., *'Control systems*', Second Edition, RBA Publications
3	Ogata, K., '*Modern Control Engineering*', 5/e, PHI.
4	Ramesh Babu, '*Digital Signal Processing*', 2/e,
5	K.Deergha Rao, Swamy MNS, '*Digital Signal Processing, Theory and Applications*', 1/e, Springer Publications, 2018

For the academic years 2020-2024

ANTENNAS AND WAVE PROPAGATION

PC 412 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To familiarize the students with the basic principles of antennas and introduce the antenna terminology and To introduce different types of wire antennas and make proficient in analytical skills for understanding practical antennas
2	To familiarize with the design of different types of antennas for various frequency ranges and latest developments in the practical antennas and To introduce need for antenna arrays and the concepts of measurements of antennas
3	To introduce the various modes of Radio Wave propagation used

Outcomes: On successful completion of the course, the students would be able to

1.	To illustrate the basic principles of antennas and learn the antenna terminology
2.	To design different types of wire antennas and make proficient in analytical skills for understanding practical antennas
3.	To design different types of antennas for various frequency ranges and get updated with latest developments in the practical antennas
4.	To apply the principles of antennas, to design antenna arrays and measure various parameters of antennas
5.	To Identify and understand the suitable modes of Radio Wave propagation used in current practice.

UNIT – I

Antenna Fundamentals:

Introduction, Fundamental Concepts- Physical concept of radiation, Retarded potential. Radiation pattern, Isotropic Radiator, Front–to-back ratio, Antenna Field Regions, Radiation Intensity, Beam Area, Beam Efficiency, Reciprocity, Directivity and Gain, Antenna Apertures, Antenna Polarization, Antenna impedance, Antenna temperature, Friis transmission equation.

UNIT – II

Thin Linear wire Antennas:

Current Distributions, Radiation from Infinitesimal Dipole, Half wave Dipole and Quarter wave Monopole, Loop Antennas - Introduction, Small Loop, Far field pattern of circular loop with uniform current, Comparison of far fields of small loop and short dipole, Slot Antennas, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes, wideband characteristics, radiation efficiency.

UNIT – III

Non-Resonant Antennas:

V- antenna, Rhombic Antenna, Yagi - Uda Antenna, Folded Dipoles & their Characteristics, Log- periodic Antenna, Aperture Antennas- Huygens principle, Radiation from

apertures, Babinets principle, Radiation from Horns and design considerations, Parabolic Reflector and Cassegrain Antennas, Lens Antennas, Micro Strip Antennas- Basic characteristics, feeding Methods, Design of Rectangular Patch Antennas, Smart Antennas- Fixed weight Beam Forming basics and Adaptive Beam forming.
UNIT – IV
Antenna Arrays: Array of point sources, two element array with equal and unequal amplitudes, different phases, linear n- element array with uniform distribution, Broadside and End fire arrays, Principle of Pattern Multiplication, Effect of inter element phase shift on beam scanning, Binomial array. Antenna Measurements: Introduction, Antenna Test Site and sources of errors, Radiation Hazards, Patterns to be Measured, Radiation, Gain and Impedance Measurement Techniques.
UNIT – V
Wave Propagation: Ground wave propagation, Space and Surface waves, Troposphere refraction and reflection, Duct propagation, Sky wave propagation, Regular and irregular variations in ionosphere Line of sight propagation.

Suggested Reading:

1	J. D. Kraus, R. J. Marhefka& Ahmad S. Khan, "Antennas and wave Propagation", McGraw-Hill, 4rth Edition, 2010.
2	Constantine A. Balanis, & quot;Antenna Theory: Analysis and Design" Wiley, 3rd edition, Faculty of Engineering O.U. With effect from Academic Year 2020 – 2137 2005
3	Edward C. Jordan and Kenneth G. Balmain, '*Electromagnetic Waves and Radiating Systems'*, 2/e, PHI, 2001
4	R.E.Collins, '*Antennas and Radio Propagation'*, Singapore: McGraw Hill, 1985. q
5	R Harish and M. Sachidananda, '*Antennas and Wave Propagation'*, Oxford University Press,2011.

For the academic years 2020-2024

INDUSTRIAL ADMINISTRATION AND FINANCIAL MANAGEMENT

HS 104 ME

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To understand various types of organizational structures, manufacturing processes and importance of plant layout and the role of scheduling function in optimizing the utilization of resources
2	To understand the importance of quality, inventory control and concepts like MRP I and MRP II.
3	To understand the nature of financial management and concepts like breakeven analysis, depreciation and replacement analysis

Outcomes: On successful completion of the course, the students would be able to

1	Understand the different phases of product life cycle, types of manufacturing systems, plant layout optimization problems and role of scheduling function in better utilization of resources
2.	Understand the Fundamental concepts of quality control, process control, material control and appreciate the importance of MRP-I and MRP –II
3.	Know the different terminology used in financial management and understand the different techniques of capital budgeting and various types of costs involved in running an industrial organization.

UNIT – I
Industrial Organization: Types of various business organisations, Organisation structures and their relative merits and demerits. Functions of management. Plant Location and Layouts: Factors affecting the location of plant and layout. Types of layouts and their merits and demerits..
UNIT – II
Work Study: Definitions, objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time by time study and work sampling. Performance rating factor. Types of ratings. Jobs evaluation and performance appraisal. Wages, incentives, bonus, wage payment plans.
UNIT – III
Inspection and Quality Control: Types and objectives of inspection S.Q.C., its principles. Quality control by chart and sampling plans. Quality circles, introduction to ISO.
UNIT – IV
Optimization: Introduction ot linear programming and its graphical solutions. Assignment problems. ***Project Management:*** Introduction to CPM and PERT .Determination of critical path. ***Material Management:*** Classification of materials, Materials planning. Duties of purchase manager. Determination of economic ordering quantities. Types of materials purchase.

UNIT – V
Cost Accounting: Elements of cost. Various costs. Types of overheads. Breakeven analysis and its applications. Depreciation. Methods of calculating depreciation fund. Nature of financial management. Time value of money.Techniques of capital budgeting and methods. Cost of Capital, Financial leverage

Suggested Reading:

1	Pandey I.M., '*Elements of Financial Management'*, Vikas Pulications House, New Delhi, 1994.
2	Khanna O.P., '*Industrial Engineering and Management'*, Dhanapat Rai & Sons.
3	Marshall/Bansal, '*Financial Engineering'*, PHI.
4	Keown, '*Financial Management'*, 9/e, PHI.
5	Chandra Bose, '*Principles of Management &Administration'*, PHI.

MICROPROCESSOR AND MICROCONTROLLER LAB

PC 455 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.Apply Assembly language programs on 8086 trainer kit in standalone/serial mode
2.Classify interface modules into input /output and Memory interfaces with 8086
3.Develop and execute the embedded C programming concepts of 8051 microcontroller

Outcomes: On successful completion of the course, the students would be able to

1. Apply different addressing modes & Model programs using 8086 Instruction set
2. Explain the usage of string instructions of 8086 for string manipulation, Comparison
3. Develop interfacing applications using 8086 processor
4. Design different programs using C cross compilers for 8051 controller
5. Develop interfacing applications using 8051 controller

List of Experiments
PART- A

1. Use of 8086 trainer kit and execution of programs. (Instruction set for simple Programs using 4 to 5 lines of instruction code under different addressing modes for data transfer, manipulation, Arithmetic operations)
2. Branching operations and logical operations in a given data.
   i) transfer byte and word data from source to destination memory.
   ii) Count even and odd numbers from given Array of ten bytes.
   iii) Find Largest and Smallest number from given array of words
   iv) Sort the Given array in ascending order ,Descending order
3. Multiplication and division
   i) Use MUL and IMUL for Unsigned and signed multiplication on 8 bit and 16bit data sets
   ii) Use DIV and IDIV for Unsigned and signed division on 8 bit and 16bit data sets
   iii) Obtain given decimal number to unpacked BCD ex: 123410 as 01,02,03,04 and store in memory using DIV
   iv) Find Factorial of a given number using multiplication instructions
4. Single byte, multi byte Binary and BCD addition and subtraction
5. Code conversions.
   i) BCD Unpacked to Packed BCD
   ii) ASCII code to BCD code
   iii) BCD to ASCII
6. String Searching and Sorting.(Using string instructions)
   i) Find number of repetitions of a character in a string

ii) Find and replace a character in the given string
iii) Convert Case of a given string
iv) Find whether given string is palindrome or not

Part B

[Experiments for 8051 using any C- Cross Compiler & appropriate hardware]

1. Familiarity and use of 8051/8031 Microcontroller trainer, and execution of programs.
2. Instruction set for simple Programs (using 4 to 5 lines of instruction code).
3. Timer and counter operations & programming using 8051.
4. Serial communications using UART
5. Programming using interrupts
6. Interfacing 8051 with DAC to generate waveforms.
7. Interfacing traffic signal control using 8051.
8. Program to control stepper motor using 8051.
9. ADC interfacing with 8051
10. Serial RTC interfacing with 8051
11. LCD interfacing with 8051

NOTE: PART-B Perform using assembler simulators like edsim51/keil software

SYSTEMS AND SIGNAL PROCESSING LAB

PC 456 EC

Instruction: 2 periods per week *Duration of SEE:3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1	Implement the basic algorithms of DFT, IDFT, FFT and IFFT
2	Design FIR Filter with specific magnitude and phase requirements
3	Design IIR Filter with specific magnitude and phase requirements

Outcomes: On successful completion of the course, the students would be able to

1.	Illustrate various signal processing algorithms.
2.	Analyze FIR Filter with specific magnitude and phase requirements
3.	Analyze IIR Filter with specific magnitude and phase requirements
4.	Illustrate the basics of Multirate signal processing
5.	Analyze digital filters on DSP processors

PART-A

List of Signal Processing Experiments

Perform the following programs using MATLAB Simulator

1. Introduction to MATLAB and signal generation.
2. Perform DFT and FFT algorithm.
3. Perform Linear convolution.
4. Perform Circular Convolutions.
5. Perform FIR filters design using different window functions.
6. Perform IIR filters design: Butterworth and Chebyshev.
7. Perform Interpolation and Decimation.
8. Perform Implementation of multi-rate systems.
9. Perform Time response of non –linear systems.
10. Design of P, PI, PD and PID controllers (any two)

PART-B
List of DSP Processor Experiments

Implement the following experiments using DSK

1. Introduction to DSP processors.
2. Implement Solution of difference equations
3. Implement Impulse Response.
4. Implement Linear Convolution.
5. Implement Circular Convolution.
6. Perform Study of procedure to work in real-time.
7. Implement Fast Fourier Transform Algorithms.
8. Design of FIR (LP/HP) USING windows: (a) Rectangular (b) Triangular (c) Hamming windows.
9. Design of IIR (HP/LP) filters.

NOTE:

1. At least ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and 5 from Part B is Compulsory.
3. For Section 'A' MATLAB with different toolboxes like signal processing.
4. Block set and SIMULINK / MATHEMATICA / any popular software can be used.

Suggested Reading:

1. Jaydeep Chakravorthy, '*Introduction to MATLAB Programming: Toolbox and Simulink*',1/e, University Press,2014.

MINI PROJECT LAB

PC 457 EC

Instruction: 2 periods per week *Duration of SEE:- NA*
CIE: 50 marks *SEE:- NA*
Credits: 1

Objectives:

1.	Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2.	To provide training in soft skills and also train them in presenting seminars and technical report writing.
3.	Design, implement and test the prototype/algorithm in order to solve the conceived problem.

Outcomes: On successful completion of the course, the students would be able to

1.	Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2.	Gain working practices within Industrial/R&D Environments
3.	Prepare reports and deliver effective presentation.
4.	Demonstrate effective written and oral communication skills
5.	To encourage students to work on innovative and entrepreneurial ideas.

Guidelines for Mini Project

1. The mini-project is a team activity having maximum of 3 students in a team. This is electronic product design work with a focus on electronic circuit design.

2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.

3. Mini Project should cater to a small system required in laboratory or real life.

4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.

5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.

6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.

7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

8. Art work and Layout should be made using CAD based PCB simulation software. Due

considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.

9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VI - Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PC 413 EC	Digital Communication	3	-	-	3	30	70	3	3
2	PC 414 EC	VLSI Design	3	-	-	3	30	70	3	3
3	PC 415 EC	Data Communication and computer networks	3	-	-	3	30	70	3	3
4	PE 5XX EC	Professional Elective-I	3	-	-	3	30	70	3	3
5	PE 5XX EC	Professional Elective-II	3	-	-	3	30	70	3	3
6	OE 6XX YY	Open Elective-I	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	PC 458 EC	Communication Lab	-	-	2	2	25	50	2	1
8	PC 459 EC	VLSI Lab	-	-	2	2	25	50	2	1
9	PC 460 EC	DCCN Lab	-	-	2	2	25	50	2	1
10	PW 701 EC	Summer Internship	-	-	-	-	-	50*	-	2
Total			**18**	**-**	**6**	**24**	**255**	**570**	**24**	**23**

PC: Professional Core **PE:** Professional Elective
OE: Open Elective **PW:** Project Work / Internship
L: Lecture **T:** Tutorial **P:** Practical
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)
EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment
3. *The students have to undergo a Summer Internship of four weeks duration after VI semester and credits will be awarded in VII semester after evaluation.

Professional Elective 1		
Sl.No	**Code**	**Name of Subject**
1	**PE 501 EC**	Digital Image and Video Processing
2	**PE 502 EC**	Wireless Communication
3	**PE 503 EC**	Introduction to Python Programming
4	**PE 504 EC**	Neural Networks

Professional Elective 2		
Sl.No	**Code**	**Name of Subject**
1	**PE 505 EC**	Digital system design using FPGA
2	**PE 506 EC**	Advanced Micro controllers(ARM)
3	**PE 507 EC**	CMOS Analog IC Design
4	**PE 508 EC**	IOT system Design and Applications

For the academic years 2020-2024

DIGITAL COMMUNICATION

PC 413 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Familiarize the students with elements of digital communication system and waveform coding techniques like PCM, DPCM, DM and ADM.
Introduce the concepts of information theory and source coding
Familiarize the students with channel coding techniques such as LBC, BCC and convolution codes and Introduce the concepts of baseband digital data transmission and analyze the error performance of different digital carrier modulation schemes like ASK, FSK, PSK etc

Outcomes: On successful completion of the course, the students would be able to

1.Classify the different types of digital modulation techniques PCM, DPCM, DM and ADM and compare their performance by SNR.
2.Illustrate the classification of channels and Source coding methods.
3.Distinguish different types of Error control codes along with their encoding/decoding algorithms
4.Examine the Performance of different Digital Carrier Modulation schemes of Coherent and Non-coherent type based on Probability of error
5.Generation of PN sequence using Spread Spectrum and characterize the Acquisition Schemes for Receivers to track the signals.

UNIT – I
Elements of Digital Communication System: Check with autonomous Comparison of Digital and Analog Communication Systems, Analog to Digital Conversion, Quantization and Encoding techniques, PCM. Companding in PCM systems - u law and a law, Applications of PCM: Introduction to Linear Prediction Theory. Modulation and demodulation of DPCM, DM and ADM. Comparison of PCM, DPCM, DM and ADM. SNRQ of PCM and DM
UNIT – II
Information Theory and Source Coding*:* Uncertainty, Information and entropy. Source-coding, Shannon – Fano and Huffman coding Discrete memory less channel – Probability relations in a channel, priori & posteriori entropies, mutual information, Channel capacity - Binary Symmetric Channel, Binary Erasure Channel, , cascaded channels, information rate. Shannon-Hartley Theorem – Shannon Bound.
UNIT – III
Channel Coding*:* Types of transmission errors, need for error control coding, Linear Block Codes (LBC): description of LBC, generation, Syndrome and error detection, Minimum distance of Linear block code, error correction and error detection capabilities, Standard array and syndrome decoding, Hamming codes. Binary cyclic codes (BCC): Description of cyclic codes, encoding, decoding and error correction using shift registers. Convolution codes: description, encoding – code tree, state diagram

UNIT – IV
Introduction to Base band digital data transmission –block diagram, ISI, eye pattern Digital Carrier Modulation Schemes — Description and generation of ASK, FSK, PSK optimum receiver – matched filter, correlation receiver. Gaussian error probability -Coherent detection of Binary ASK, FSK, PSK DPSK Comparison of digital carrier modulation schemes M-ary signaling schemes – Introduction, QPSK,Synchronization methods
UNIT – V
Spread Spectrum Communication: Advantages of Spread Spectrum, generation and characteristics of PN sequences. Direct sequence spread spectrum and Frequency hopping spread spectrum systems and their applications. Acquisition and Tracking of DSSS and FHSS signals

Suggested Reading:

1	Simon Haykin, "*Communication systems*" 4/e, Wiley India 2011
2	Sam Shanmugam K, '*Digital and Analog Communication systems*', Wiley 1979.
3	B.P.Lathi, '*Modern digital and analog communication systems*' 3/e, OxfordUniversity Press. 1998
4	Leon W.Couch II., '*Digital and Analog Communication Systems'*, 6th Edn, Pearson Education inc., New Delhi, 2001
5	R.E.Zimer&R.L.Peterson : '*Introduction to Digital Communication'*, PHI, 2001

VLSI Design

PC 414 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of inverters designed with various loads
2. Give exposure to the design rules to be followed to draw the layout of any logic circuit and Provide concept to design different types of Combinational and arithmetic circuits.
3. Learn to design sequential logic circuits using CMOS transistor and Study the small signal model various amplifiers

Outcomes: On successful completion of the course, the students would be able to

1. Analyze modes of operation of MOS transistor and its basic electrical properties
2. Draw stick diagrams and layouts for any MOS transistors and calculate the parasitic R&C
3. Analyse the operation of various arithmetic circuits.
4. Design sequential logic circuits using CMOS transistors
5. Understand the small signal model and characteristics of CMOS amplifiers

UNIT – I
Introduction to HDLs: Overview of Digital Design with Verilog HDL, Hierarchical modeling, Gate level Modeling, Dataflow modeling, Behavioural Modeling. Design of Arithmetic Circuits - Adders, Subtractors, 4- bit Binary and BCD adders and 8-bit Comparators and MSI combinational logic modules: ALUs, Encoders, Decoders, Multiplexers, Demultiplexers, using various modeling techniques. Design of stimulus blocks.
UNIT – II
Behavioral modeling of sequential logic modules: Latches, Flip Flops, counters and shift registers, Memory(RAM and ROM). Synchronous Sequential Circuits: Synthesis of synchronous sequential circuits: Mealy and Moore FSM models for sequence detector, Modulo-8 Counter, One-Hot Encoder. Brief discussion on ASIC and FPGA design flow.
UNIT – III
Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS technologies-Fabrication Process. ***Basic Electrical Properties :*** Basic Electrical Properties of MOS and Bi-CMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.
UNIT – IV

***VLSI Circuit Design Processes*:** VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling. ***Gate Level Design* :** Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Basic circuit concepts, Sheet Resistance RS and its concept to MOS, Area Capacitance Units, Calculations – RC Delays.
UNIT – V
Subsystem Design*:** Shifters, Adders: Carry skip, carry select, square root carry select , Manchester; ALU, Multipliers: Booth, Baugh-Woolley, High Density Memory Elements: SRAM, DRAM, ROM Design. ***Sequential Logic Design: Behavior of Bi-stable elements, SR Latch, Clocked Latch and Flip-flop circuits, CMOS D latch and Edge triggered Flip flops.

Suggested Reading:

1	Kamran Eshraghian Dougles and A. Pucknell, '*Essentials of VLSI circuits and systems*', PHI, 2005 Edition.
2	Weste and Eshraghian '*Principles of CMOS VLSI Design*', Pearson Education, 1999.
3	John .P. Uyemura, '*Introduction to VLSI Circuits and Systems*', JohnWiley, 2003
4	John M. Rabaey, '*Digital Integrated Circuits*', PHI, EEE, 1997.
5	Wayne Wolf, '*Modern VLSI Design*', Pearson Education, 3rd Edition, 1997

For the academic years 2020-2024

DATA COMMUNICATION AND COMPUTER NETWORKING

PC 415 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture and To study the principles of network protocols and internetworking
2. To understand the Network security and Internet applications and To understand the concepts of switched communication networks.
3. To understand the performance of data link layer protocols for error and flow control and To understand various routing protocols and network security.

Outcomes: On successful completion of the course, the students would be able to

1.Understand the working of various network topologies and circuit and packet switching
2.Comprehend the role of data link layers and significance of MAC protocols
3.Understand the networking protocols and Internet protocols
4.Understand the transport layer working with TCP, UDP and ATM protocols
5.Comprehend the functionality of application layer and importance of network security

UNIT – I
Introduction to Data communication: A Communication Model, The Need for Protocol Architecture and Standardization, Network Types: LAN, WAN, MAN. Network Topologies: Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP.Circuit Switching Principles and concepts,Virtual circuit and Datagram subnets, X.25.
UNIT – II
Data Link Layer: Need for Data Link Control, Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC. MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.4, 802.11, 802.15, 802.16 standards. Bridges and Routers.
UNIT – III
Network Layer: Network layer Services, Routing algorithms: Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.***Internet Working:*** The Network Layer in Internet: IPV4, IPV6, Comparison of IPV4 and IPV6, IP Addressing, ATM Networks.
UNIT – IV
Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

UNIT – V
Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web. **Network *Security:*** Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols

Suggested Reading:

1.	Andrew S Tanenbaum, '*Computer Networks'*, 5/e, Pearson Education, 2011.
2.	Behrouz A. Forouzan, '*Data Communication and Networking'*,3/e, TMH, 2008.
3.	William Stallings, '*Data and Computer Communications'*, 8/e, PHI, 2004
4.	Douglas EComer, '*Computer Networks and Internet*', Pearson Education Asia, 2000
5.	PrakashC. Gupta, '*Data Communications and Computer Networks'*, PHI learning, 2013

For the academic years 2020-2024

COMMUNICATION ENGINEEERING LAB

PC 458 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1. Demonstrate AM, FM, Mixer, PAM, PWM and PPM techniques and Understand multiplexing techniques.
2. Understand and simulate digital modulation (i.e., ASK, FSK, BPSK, QPSK) generation and detection and Model analog, pulse modulation, PCM, Delta and Digital modulation techniques using CAD tools
3. Obtain data formats.

Outcomes: On successful completion of the course, the students would be able to

1. Understand and simulate modulation and demodulation of AM and FM.
2. Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively
3. Understand and simulate the PAM,PWM&PPM circuits
4. Understand baseband transmission (i.e., PCM, DPCM, DM, and ADM) generation and detection.
5 . Understand error detection and correction

PART-A

List of Analog Communication Experiments

1. Perform AM modulation and demodulation
2. Perform FM modulation and demodulation
3. Perform Pre emphasis and De-emphasis
4. Perform Multiplexing Techniques (FDM and TDM)
5. Perform Mixer Characteristics
6. Perform Sampling , PAM, PWM, PPM generation and detection

PART-B

List of Digital Communication Experiments

1. Perform PCM modulation and demodulation
2. Perform channel encoding and decoding.
3. Perform Linear and Adaptive Delta Modulation and Demodulation
4. Perform ASK generation and Detection.
5. Perform FSK and Minimum Shift Keying generation and Detection.
6. Perform Generation and Detection of PCM, Delta modulation and Digital modulation Schemes (ASK. FSK, BPSK, QPSK) by using MATLAB/Simulink/Lab-view.

Note: At least ten experiments should be conducted in the semester, of which five should be from PART - B.

VLSI LAB

PC 459 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1. Describe verilog HDL and develop digital circuits using gate level, data flow and Behavioural modeling
2. Design and develop of digital circuits using Finite State Machines(FSM)
3. Perform functional verification of above designs using Test Benches and Implementation of experiments on FPGA/CPLD boards.

Outcomes: On successful completion of the course, the students would be able to

1. Appreciate the constructs and conventions of the verilog HDL programming in gate level and data flow modeling
2. Generalize combinational circuits in behavioral modeling and concepts of switch level modeling
3. Design and analyze digital systems and finite state machines.
4. Perform functional verification by writing appropriate test benches.
5. Implement designs on FPGA/CPLD boards.

List of Experiments:

Write the Code using VERILOG, Simulate and synthesize the following:

1. Write structural and dataflow Verilog HDL models for
   a) 4-bit ripple carry adder.
   b) 4-bit carry Adder – cum Subtractor.
   c) 2-digit BCD adder / subtractor.
   d) 4-bit carry look ahead adder
   e) 4-bit comparator
2. Write a Verilog HDL program in Hierarchical structural model for
   a) 16:1 mux realization using 4:1 mux
   b) 3:8 decoder realization through 2:4 decoder
   c) 8-bit comparator using 4-bit comparators and additional logic
3. Write a Verilog HDL program in behavioral model for

a) 8:1 mux

b) 3:8 decoder

c) 8:3 encoder

d) 8 bit parity generator and checker

4. Write a Verilog HDL program in structural and behavioral models for
   a) 8 bit asynchronous up-down counter b) 8 bit synchronous up-down counter
5. Write a Verilog HDL program for 4 bit sequence detector through Mealy and Moore state machines.
6. Write a Verilog HDL program for traffic light controller realization through state machine.
7. Write a Verilog HDL program for vending machine controller through state machine.
8. Write a Verilog HDL program in behavioral model for 8 bit shift and add multiplier.
9. Write a Verilog HDL program in structural model for 8 bit Universal Shift Register.
10. Write a Verilog HDL program for implementation of data path and controller units
    a) Serial Adder b) ALU

Note:

1. All the programs should be simulated using test benches.
2. Minimum of five experiments to be implemented on FPGA/CPLD boards.

DATA COMMUNICATION AND COMPUTER NETWORKING LAB

PC 460 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: - marks*
Credits : 1

Objectives:

1. To provide a conceptual foundation for the study of data communications using the open Systems interconnect (OSI) model for layered architecture.
2. To study the principles of network protocols and internetworking
3. To understand the concepts of switched communication networks.
4. To understand the performance of data link layer protocols for error and flowcontrol.
5. To understand various routing protocols.

Outcomes: On successful completion of the course, the students would be able to

1. Understand the working of various network topologies and circuit and packet switching.
2. Comprehend the role of data link layers and significance of MAC protocols.
3. Understand the networking protocols and the internet protocols.
4. Understand the transport layer working with TCP, UDP and ATM protocols.
5. Comprehend the functionality of application layer

List of Experiments
PART-A

1. Study of network devices in detail.

Design and implement the following experiments using C compiler or and packet tracer software

2. A HLDC frame to perform the following.

   i) Bit stuffing
   ii) Character stuffing.
3. Distance vector algorithm and find path for transmission.
4. Dijkstra's algorithm to compute the shortest routing path.
5. Simulation of network topologies.
6. Configuration of a network using different routing protocols.

PART-B

Simulate experiments using NS2/ NS3/ NCTUNS/ NetSim/ or any other equivalent tool.

7. Implement a point to point network with four nodes and duplex links between them. Analyse the network performance by setting the queue size and varying the bandwidth.
8. Implement a four node point to point network with links n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3 and UDP between n1-n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP/UDP.
9. Implement Ethernet LAN using n (6-10) nodes. Compare the throughput by changing the error rate and data rate.
10. Implement Ethernet LAN using n nodes and assign multiple traffic to the nodes and obtain congestion window for different sources/ destinations.
11. Implement ESS with transmission nodes in Wireless LAN and obtain the performance parameters.
12. Implementation of Link state routing algorithm.

Note: **Do any 5 experiments from each part.**

Summer Internship

PW 701 EC

Instruction: 2 periods per week *Duration of SEE: NA*
CIE: 50 marks *SEE: NA*
Credits : 2

Objectives:

1.	To enhance practical and professional skills.
2.	To provide training in soft skills and also train them in presenting seminars and technical report writing.
3.	To expose the students to industry practices and team work

Outcomes: On successful completion of the course, the students would be able to

1.	Get Practical experience of software design and development, and coding practices within Industrial/R&D Environments.
2.	Gain working practices within Industrial/R&D Environments
3.	Prepare reports and deliver effective presentation.
4.	Demonstrate effective written and oral communication skills
5.	To encourage students to work on innovative and entrepreneurial ideas.

Summer Internship is introduced as part of the curricula of encouraging students to work on problems of interest to industries. A batch of three students will be attached to a person from the Government or Private Organisations/Computer Industry/Software Companies/R&D Organization for a period of 4-6 weeks. This will be during the summer vacation following the completion of the III-year Course. One faculty coordinator will also be attached to the group of 3 students to monitor the progress and to interact with the industry co-ordinate (person from industry).

The course schedule will depend on the specific internship/training experience. The typical time per topic will vary depending on the internship

- Overview of company/project
- Safety training
- Discussions with project teams
- Background research, review of documents, white papers, and scientific papers
- Planning, designing, and reviewing the planned work
- Executing the plans
- Documenting progress, experiments, and other technical documentation
- Further team discussions to discuss results
- Final report writing and presentation

After the completion of the project, each student will be required to:

1. Submit a brief technical report on the project executed and
2. Present the work through a seminar talk (to be organized by the Department)

Award of internal marks are to be based on the performance of the students at the workplace and awarded by industry guide and internal guide (25 Marks) followed by presentation before the committee constituted by the department (25 Marks). One faculty member will co-ordinate the overall activity of Industry Attachment Program.

Note: Students have to undergo summer internship of 4-6 weeks at the end of semester VI and credits will be awarded after evaluation in VII semester.

For the academic years 2020-2024

PROFESSIONAL ELECTIVE I

DIGITAL IMAGE AND VIDEO PROCESSING

PE 501 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To provide an introduction to the basic concepts and methodologies for Digital Image processing. of communications systems
2.To familiar with spatial and transform domain techniques used in Image Enhancement, Restoration and Segmentation of Images
3. To gain knowledge about various Image transforms used in Image processing and Image compression problems and To understand various methods employed for edge, line and isolated points detection in an image.

Outcomes: On successful completion of the course, the students would be able to

1. Able to develop a foundation that can be used as the basis for higher study and research in the Image processing area
2. Able to design various filters for processing and deblurring of images without destroying fine details like edges and lines.
3. Able to apply image processing techniques for processing and analysis of remotely sensed, Microscope, Radar and Medical images.
4. Able to understand the need for Digital Image processing techniques for Machine vision applications and concept of image compression

UNIT – I
Fundamentals of Image Processing and Image Transforms: Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels **Image Transforms:** 2 D- Discrete Fourier Transform, Discrete Cosine Transform (DCT), Wavelet **Transforms:** Continuous Wavelet Transform, Discrete Wavelet Transforms.
UNIT – II
Image Processing Techniques: Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. **Frequency domain methods:** Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering. Laplacian of Gaussian (LOG) filters. **Image Segmentation:** Segmentation concepts, Point, Line and Edge Detection, Thresholding, Region Based segmentation, Hough Transform, Boundary detection, chain coding.
UNIT – III
Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models: Lossy & Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, Wavelet coding, JPEG

Standards.
UNIT – IV
Basic concepts of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations
UNIT – V
2-D Motion Estimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding, constant dependent video coding and joint shape and texture coding .

Suggested Reading:

1.	Rafeal C.Gonzalez, Richars E.Woods, 'Digital Image Processing', Pearsons Education, 2009, 3rd Edition.
2.	Anil K Jain 'Fundamentals of Digital Image Processing', Prentice-Hall of India Private Limited, New Delhi, 1995
3.	Yao Wang, Joem Ostermann , Ya–quin Zhang, Video processing and communication, 1st Edition, PH Int.
4.	Vipul Singh 'Digital Image Processing with Matlab and Lab view' Elsevier 2013
5.	John Woods, Multi-dimensional Signal, Image and Video Processing and Coding 2nd Edition, Elsevier.

For the academic years 2020-2024

PROFESSIONAL ELECTIVE I

WIRELESS COMMUNICATION

PC 502 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Know the characteristics of wireless channels.
2. Learn the various cellular architectures and Be familiar with advanced transceiver schemes.
3. Understand the concepts of various digital signaling schemes for fading channels and Understand the various multiple antenna systems.

Outcomes: On successful completion of the course, the students would be able to

1. Characterize wireless channels
2. Design a cellular system
3. Analyze the advanced transceiver schemes
4. Design and implement various signaling schemes for fading channels
5. Design and implement MIMO system and analyze the performance

UNIT – I
Wireless channels: Large scale path loss – Path loss models: Free Space and Two-Ray models- Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.
UNIT – II
***Cellular architecture*:** Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement.
UNIT – III
Advanced Transceiver Schemes: Spread Spectrum Systems- Cellular Code Division Multiple Access Systems- Principle, Power control, Effects of multipath propagation on Code Division Multiple Access, Transceiver implementation, Second Generation (GSM, IS–95) and Third Generation Wireless Networks and Standards
UNIT – IV
Digital Signaling For Fading Channels: Structure of a wireless communication link Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR. , Equalizers- Linear and Decision Feedback equalizers

UNIT – V
Multiple Antenna Techniques: MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

Suggested Reading:

1	Rappaport T.S., '*Wireless communications'*, Second Edition, Pearson Education, 2010
2	Andreas.F. Molisch . '*Wireless Communications'*, John Wiley – India, 2006.
3	David Tse and Pramod Viswanath '*Fundamentals of Wireless Communication'*, Cambridge University Press, 2005.
4	Upena Dalal '*Wireless Communication'*, Oxford University Press, 2009
5	VanNee R. and Ramji Prasad, '*OFDM for wireless multimedia communications'*, Artech House, 2000

For the academic years 2020-2024

PROFESSIONAL ELECTIVE I

INTRODUCTION TO PYTHON PROGRAMMING

PE 503EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To learn concepts of Python programming
2. To understand object oriented programming concepts in Python
3. To gain knowledge about Algorithms and Data structures.

Outcomes: On successful completion of the course, the students would be able to

1. Understand the basic concepts in Python programming.
2. Demonstrate the use of advanced data types such as tuples, dictionaries and list..
3. Design solutions for real time problems using object oriented concepts in Python
4. Acquire concepts of Algorithm, Data structures and Regular Expressions in Python
5. Demonstrate file handling capabilities and using advance python libraries.

UNIT – I
Introduction to Python Programming, History of Python, its features, Scope of Python, Downloading and installing Python, Python code execution process, run a simple program on Python interpreter and IDLE. The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Conditions, boolean logic, logical operators; ranges; Illustrative programs.
UNIT – II
Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation. Illustrative programs, Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries. Illustrative programs
UNIT – III
Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling, inheritance, polymorphism, operator overloading, exception handling, try block. Illustrative programs
UNIT – IV
Algorithm and Data Structure: Stack, Queue, Tree, ordered list, Introduction to Recursion, Divide and Conquer Strategy, Greedy Strategy, Graph Algorithms. Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.
UNIT – V
I/O and Error Handling In Python :Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File

Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories. Installing and Exploring different python libraries used in Graphical User Interface designing (tkinter), database connectivity using Python (pymysql), Illustrative programs .

Suggested Reading:

1	John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
2	Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall
3	Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley
4	Kenneth A. Lambert, "Fundamentals of Python – First Programs", CENGAGE Publication
5	Mircea Dragoman, Daniela Dragoman, '*Nanoelectronics: principles and devices*', CRC Press 2006.

For the academic years 2020-2024

PROFESSIONAL ELECTIVE I

NEURAL NETWORKS

PC 504 EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To understand the functioning of biological neuron and its electronic implementation using different Neuron models and The activation & synaptic dynamics of Neural Networks & its distinction
2	To understand the concepts of pattern recognition tasks as applied to Neural Networks and The concepts of Perceptron Neural Networks & train different Feed forward Neural Networks
3	To train different Feedback Neural Networks & their applications

Outcomes: On successful completion of the course, the students would be able to

1	To differentiate between Biological Neuron & Artificial Neuron and different Neuron Models
2	To analyze activation & synaptic dynamics of Neural Networks
3	To summarize the Pattern Recognition Tasks & different Neural Network memories
4	To solve Perceptron XoR problem & write different training algorithms for Feed forward Neural Networks
5.	To understand & train different Feedback Neural Networks and their applications

UNIT – I
Introduction to Neural Networks: Description of Biological Neuron, Mathematical model of Artificial Neural Network, Classification of Neural Networks, Different Neuron models: McCulloch-Pitts Neuron model, Perceptron Neuron model and ADALINE Neuron model, Basic learning laws
UNIT – II
Activation and Synaptic dynamics of Neural Networks: Additive, Shunting and Stochastic activation models, Distinction between Activation and Synaptic dynamics models, Requirements of learning laws, Recall in Neural Networks.
UNIT – III
Pattern Recognition Tasks: Pattern association, pattern storage (LTM & STM), Pattern clustering and feature mapping, Neural Network Memory: Auto Associative Memory, Hetero Associative Memory, Bidirectional Associative Memory.
UNIT – IV
Feed Forward Neural Networks: Single layer & Multi layer Neural Networks, Peceptron Neural Networks solution of XoR problem, Perceptron Convergence Theorem, Back Propagation Neural Networks, its features, limitations & extensions, Kohonen Self-Organizing Networks & its applications

UNIT – V
Feedback Neural networks: Hopfield network, capacity and energy analysis of Hopfield Neural Network & its applications, Radial Basis Function Networks, its training algorithm & applications, Boltzmann machine, Boltzman learning law.

Suggested Reading:

1	B. Yeganaranarana '*Artificial Neural Networks'*, Prentice Hall, New Delhi, 2007.
2	J.A.Freeman and D.M.Skapura '*Neural Networks Algorithms, Applications and Programming Techniques'*, Addison Wesley, New York, 1999.
3	Simon Haykin '*Neural Networks (A Comprehensive Foundation)*,' McMillan College Publishing Company, New York, 1994. S.N. Sivanandam & M.Paul Raj, *Introduction*
4	S.N. Sivanandam & M.Paul Raj '*Introduction to Artificial Neural Networks'*, Vikas Publishing House Pvt Limited, 2009.
5	Richard O.Duda Peter E Heart, David G.Stork, '*Pattern Classification'*, John Wiley & Sons 2002

For the academic years 2020-2024

PROFESSIONAL ELECTIVE II

DIGITAL SYSTEM DESIGN USING FPGA

PE 505EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Learn Application Specific IC (ASIC) fundamentals and describe FPGAs
2. Calculate power consumption of designed IC and understand the concepts of interconnection, placement and routing schemes.
3. Learn verification and testing schemes.

Outcomes: On successful completion of the course, the students would be able to

1. Gain Knowledge in ASIC and FPGS flows
2. Familiarity with EDA tools
3. Gain knowledge in Physical design concepts of VLSI
4. Acquire knowledge in placement and routing algorithms
5. Acquire basic idea of testing and verification techniques to test ICs

UNIT – I
Digital system design options and trade-offs, Design methodology and technology overview, High Level System Architecture and Specification: Behavioural modelling and simulation.
UNIT – II
Hardware description languages, combinational and sequential design, state machine design, synthesis issues, test benches. ***Overview of FPGA architectures and technologies:*** FPGA Architectural options, granularity of function and wiring resources, coarse vs fine grained, vendor specific issues (emphasis on Xilinx / Altera).
UNIT – III
Logic block architecture: FPGA logic cells, timing models, power dissipation I/O block architecture: Input and Output cell characteristics, clock input, Timing, Power dissipation, Programmable interconnect - Partitioning and Placement, Routing resources, delays.
UNIT – IV
Applications - Embedded system design using FPGAs, DSP using FPGAs, Dynamic architecture using FPGAs, reconfigurable systems, application case studies. Simulation / implementation exercises of combinational, sequential and DSP kernels on Xilinx / Altera boards.
UNIT – V
Introduction to High-level synthesis flow: Introduction to Vivado High level synthesis flow, Introduction to Intel High Level Synthesis Compiler. Introduction to SoC FPGAs and Architectural study of Zynq-7000 SoC.

Suggested Reading:

1	Peter Ashenden, '*Digital Design using Verilog'*, Elsevier, 2007.
2	Michael John Sebastian Smith, '*Application Specific Integrated Circuits'*, Pearson Education Asia, 3rd edition 2001.
3	W. Wolf, '*FPGA based system design'*, Pearson, 2004.
4	Clive Maxfield, '*The Design Warrior's Guide to FPGAs'*, Elsevier, 2004.

For the academic years 2020-2024

PROFESSIONAL ELECTIVE II

ADVANCED MICROCONTROLLERS

PE 506 EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	To introduce industry standard ARM microcontroller architecture
2	To develop the ability of programming the ARM using Embedded C
3	To understand the Memory and Bus Architecture of ARM microcontroller.

Outcomes: On successful completion of the course, the students would be able to

1	Comprehend the basic architecture of ARM.
2	Program the ARM using Assembly Language programming
3	Interface the ARM with peripheral devices using C program.
4	Understand the Memory management unit of ARM
5.	Comprehend the advance microprocessor bus architecture(AMBA)

UNIT – I

Introduction:

Need of advance microprocessors, Difference between RISC and CISC, RISC Design philosophy, ARM Design Philosophy, History of ARM microprocessor, ARM processor family, Development of ARM architecture.

The ARM Architecture and Programmers Model:

The Acorn RISC Machine, ARM Core data flow model, Architectural inheritance, The ARM7TDMI programmer's model: General purpose registers, CPSR, SPSR, ARM memory map, data format, load and store architecture, Core extensions, Architecture revisions, ARM development tools

UNIT – II

ARM Instruction set: Data processing instructions, Arithmetic and logical instructions, Rotate and barrel shifter, Branch instructions, Load and store instructions, Software interrupt instructions, Program status register instructions, Conditional execution, Multiple register load and store instructions, Stack instructions, Thumb instruction set, advantage of thumb instructions, Assembler rules and directives, Assembly language programs for shifting of data, factorial calculation, swapping register contents, moving values between integer and floating point registers

UNIT – III

C Programming for ARM: Overview of C compiler and optimization, Basic C data types, C Looping structures, Register allocations, function calls, pointer aliasing, structure arrangement, bitfields, unaligned data and Endianness, Division, floating point, Inline functions and inline assembly, Portability issues. C programs for General purpose I/O, general purpose timer, PWM Modulator, UART, I2C Interface, SPI Interface, ADC, DAC

UNIT – IV
Memory management units: Moving from memory protection unit (MPU) to memory management unit (MMU), Working of virtual memory, Multitasking, Memory organization in virtual memory system, Page tables, Translation look aside buffer, Caches and write buffer, Fast context switch extension
UNIT – V
Advanced Microprocessor Bus Architecture (AMBA) Advanced Microprocessor Bus Architecture (AMBA) Bus System, User peripherals, Exception handling in ARM, ARM optimization techniques

Suggested Reading:

1	Andrew N. Sloss, Dominic Symes, Chris Wright, '*ARM Systems Developer's Guides – Designing & Optimizing System Software'*,Elsevier, 2008.
2	Muhammad Ali Mazidi, *'ARM Assembly Language Programming & Architecture*', Kindle edition
3	William Hohl, Christppher Hinds, *'Arm Assembly Language, Fundamentals and Techniques'*, 2nd edition, CRC Press.

For the academic years 2020-2024

PROFESSIONAL ELECTIVE II

CMOS ANALOG IC DESIGN

PE 507 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1	Develop models of basic CMOS amplifiers and Learn the concepts of advanced current mirrors and band-gap reference circuits
2	Design and develop two-stage Opamp and Analyse applications of Opamp: comparator and oscillator
3	Familiarize with switched capacitor based circuits

Outcomes: On successful completion of the course, the students would be able to

1	Describe the small signal model and analyse the small signal amplifiers.
2	Analyse the Current mirrors and Bandgap reference circuits.
3	Design a fully compensated opamp and analyse the frequency response of the opam
4	Analyse the applications of opamp i.e. comparator and oscillators
5.	Demonstrate the knowledge of basic filter design and Implement higher order filters using Switched capacitor circuits.

UNIT – I
MOS Devices and Modeling:The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling – Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.
UNIT – II
Analog CMOS Sub-Circuits:MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.
UNIT – III
CMOS Amplifiers:Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.
UNIT – IV
CMOS Operational Amplifiers:Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.
UNIT – V
Comparators:Characterization of Comparator, Two-Stage, Open-Loop Comparators, Other OpenLoop Comparators, Improving the Performance of Open-Loop Comparators, Discrete-Time Comparators.

Suggested Reading:

1.	David Johns, Ken Martin, '*Analog Integrated Circuit Design'*, John Wiley & sons.2004
2.	Behzad Razavi, '*Design of Analog CMOS Integrated Circuits'*, Tata McGraw Hill.2002
3.	Paul.R. Gray & Robert G. Major, '*Analysis and Design of Analog Integrated Circuits'*, John Wiley & sons. 2004
4.	Jacob Baker.R.et.al., '*CMOS Circuit Design'*, IEEE Press, Prentice Hall, India, 2000

For the academic years 2020-2024

PROFESSIONAL ELECTIVE II

IOT SYSTEM DESIGN AND APPLICATIONS

PE 508 EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Learn Application Specific IC (ASIC) fundamentals and describe FPGAs
2. Calculate power consumption of designed IC and understand the concepts of interconnection, placement and routing schemes.
3. Learn verification and testing schemes.

Outcomes: On successful completion of the course, the students would be able to

1. Gain Knowledge in ASIC and FPGS flows
2. Familiarity with EDA tools
3. Gain knowledge in Physical design concepts of VLSI
4. Acquire knowledge in placement and routing algorithms
5. Acquire basic idea of testing and verification techniques to test ICs

UNIT – I
IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.
UNIT – II
M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.
UNIT – III
IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.
UNIT – IV
IoT Applications for Value Creations: Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.
UNIT – V
Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in

IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Suggested Reading:

1	Vijay Madisetti and Arshdeep Bahga, '*Internet of Things (A Hands-on-Approach*)', 1 st Edition, VPT, 2014
2	Francis daCosta, '*Rethinking the Internet of Things: A Scalable Approach to Connecting Everything*', 1 st Edition, Apress Publications, 2013
3	Cuno Pfister, '*Getting Started with the Internet of Things'*, O'Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VII- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PC 416 EC	Microwave Theory and Techniques	3	-	-	3	30	70	3	3
2	PE 5XX EC	Professional Elective 3	3	-	-	3	30	70	3	3
3	PE 5XX EC	Professional Elective 4	3	-	-	3	30	70	3	3
4	OE 6XX YY	Open Elective 2	3	-	-	3	30	70	3	3
5	OE 6XX YY	Open Elective 3	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
7	PC 460 EC	Electronic Design Automation(EDA) Lab	-	-	2	2	25	50	2	1
8	PC 461 EC	Microwave Theory and Techniques Lab	-	-	2	2	25	50	2	1
9	PW 702 EC	Project stage-I (Seminar)	-	-	2	2	50	-	2	1
Total			**15**	**-**	**6**	**21**	**250**	**450**	**21**	**18**

PC: Professional Course **PE:** Professional Elective **OE:** Open Elective
PW: Project Work / Internship

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Professional Elective-3		
S.No.	**Course Code**	**Course Title**
1.	**PE** 509 **EC**	Computer vision and Pattern Recognition
2.	PE510EC	Optical Communication
3.	PE511EC	Artificial Intelligence and Machine Learning
4.	PE512EC	Fuzzy Logic

Professional Elective-4		
S.No.	**Course Code**	**Course Title**
1.	PE513EC	IC Verification using System Verilog
2.	PE514EC	Embedded System Design
3.	PE515EC	Mixed Signal Design
4.	PE516EC	Industrial Electronics

MICROWAVE TECHNIQUES

PC 416 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.	To understand the concept of Microwave signal propagation
2.	To comprehend Microwave signal generation and amplification techniques
3.	To study the parameters of various components used in Microwave design.

Outcomes: On successful completion of the course, the students would be able to

1.	Analyze the propagation of Guided waves in different modes between parallel planes.
2.	Evaluate different parameters (Like impedance, attenuation and quality factor.) for Rectangular & Circular Waveguides &Cavity Resonators.
3.	Determine Scattering parameters of different microwave components and analyze their properties.
4.	Integrate the concept of bunching and velocity modulation to summarize the operation of microwave tubes and the high frequency limitations of conventional tubes.
5.	Analyze the principle, operation and characteristics of different microwave solid state devices.

UNIT – I

***Guided Waves*:** Propagation of TE, TM and TEM waves between parallel planes. Velocity of propagation, wave impedance, attenuation in parallel plane guides.

UNIT – II

***Waveguides*:** TE and TM waves in rectangular and circular waveguides, Wave Impedance, Characteristic Wave Impedance, Attenuation and Q of waveguides. Cavity resonators, resonant frequency and Q, Applications of cavity resonator.

UNIT – III

***Microwave Circuits and Components*:** Concept of Microwave circuit, Normalized voltage and current, Introduction to scattering parameters and their properties, S parameters for reciprocal and Non-reciprocal components- Magic Tee, Directional coupler, E and H Plane Tees and their properties, Attenuators, Phase Shifters, Isolators and circulators.

UNIT – IV

***Microwave Tubes*:** High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity and Reflex Klystron.

Theory of crossed field interaction: Principles and operation of magnetrons and crossed field amplifiers, TWT and BWO.

UNIT – V

***Microwave Solid State Devices*:** Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode.

Elements of strip lines, micro strip lines, slot lines and fin–lines.

Suggested Reading:

1	E. C. Jordan & Keith G. Balmain, '*Electromagnetic Waves and Radiating Systems*', 2/e, Pearson Education, 2006.
2	Samuel Y. Liao, '*Microwave Devices and Circuits*', 3/e, Pearson Education, 2003.
3	R. E. Collins, "*Foundations for Microwave Engineering*", 2/e, Wiley India Pvt. Ltd., 2012.
4	Annapurna Das and Sisir K. Das '*Microwave Engineering* ', McGraw Hill Education, Third edition, 2014
5	Skolnik, Krauss, Reich, '*Microwave principles'*, East West Press, 1976

ELECTRONIC DESIGN AND AUTOMATION LAB

PC 460 EC

Instruction:2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1.	Familiarize with the usage of IDE tools and execution of programs using ARM processor and know about the usage of various devices like LCD, Temperature sensor, Buzzer, Stepper Motor by interfacing them to LPC2148.
2.	Understand the designing and implementation of IoT applications using Arduino/RPi
3.	Study of VLSI Tools and implement basic gates at transistor level

Outcomes: On successful completion of the course, the students would be able to

1.	Familiarize with the usage of IDE tools and program using various on chip like LCD, Temperature sensor, Buzzer, Stepper Motor by interfacing them to ARM Processor
2.	Design the digital logic circuits in various modeling styles using Verilog HDL
3.	Familiarize with VLSI CAD tools like Mentor Graphics / Cadence
4.	Implement basic gates at transistor level

PART-A

Interfacing Programs using embedded C on ARM Micro controller Kit

1. Program to interface 8-Bit LED and switch interface
2. Program to implement Buzzer interface on IDE environment
3. Program to display message in a 2 line x 16 characters LCD display and verify the result in debug terminal
4. Stepper motor interface
5. ADC & Temperature sensor LM35 interface
6. Transmission from kit and reception from PC using serial port.

PART-B

Interfacing Programs using C / Python Programming Arduino / Raspberry Pi Kit for IoT Applications

1. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write aprogram to turn ON LED when push button is pressed or at sensor detection.
2. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings
3. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
4. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when ‘1’/’0’ is received from smartphone using Bluetooth.
5. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.

PART-C

Transistor Level implementation of CMOS circuits using VLSI CAD tool

1. Basic Logic Gates: Inverter, NAND and NOR
2. Half Adder and Full Adder
3. 4:1 Multiplexer
4. 2:4 Decoder

Note: A minimum of 10 experiments to be performed and at least 3 experiments from each part to be performed.

MICROWAVE LAB

PC 461 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 25 marks *SEE: 50 marks*
Credits : 1

Objectives:

1. Understand the characteristics of RKO and Gunn oscillator.
2. Measurement of frequency and wavelengths would be learnt by the student.
3. VSWR various TEES would be understood by the student.

Outcomes: On successful completion of the course, the students would be able to

1. Analyze frequency, Wave length, SWR and Impedance for Reflex klystron Oscillator by using its equation.
2. Evaluate of mode characteristics of Reflex klystron and V-I Characteristics of Gunn diode.
3. Analyze of the characteristics of Circulator, Isolator, Directional Coupler, Tees like (Magic tee, E & H plane tees) using the Scattering parameters.
4. Generate the Radiation pattern of different antennas like Yagi-Uda and Horn Antenna and measure the gain of the antennas.

List of experiments

1. Characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode oscillator, Power Output Vs Frequency, Power Output Vs Bias Voltage.
3. Measurement of frequency and Guide wavelength calculation:
    a. Verification of the relation between Guide wavelength, free space wavelength and cutoff
    Wavelength of X- band rectangular waveguide.
    b. Verification of the straight line relation between $(1/\lambda g)^2$ and $(1/\lambda 0)^2$ and finding the dimension of the guide.
4. Measurement of low and high VSWRs: VSWR of different components like matched terminals, capacitive and inductive windows, slide screw tuner for different heights of the tuning posts etc.
5. Measurement of impedance for horn antenna, Matched load and slide screw tuner.
6. To find the S-parameters of Directional coupler.
7. To find the S-parameters of Tees: E plane, H plane and Magic Tee.
8. To find the S-parameters of Circulator.
9. Measurement of radiation patterns for basic microwave antennas like horn and parabolic reflectors in E-plane and H-plane. Also to finding the gain, bandwidth and beamwidth these antennas.
10. How to Create, Simulate and Analyze the Dipole Antenna Structure by using EM simulation software

11. How to Create, Simulate and Analyze a Microstrip Rectangular Patch Antenna by using EM simulation software
12. How to Create, Simulate and Analyze a Probe Feed Patch Antenna by using EM simulation software
13. How to Create, Simulate and Analyze a The Triangular Microstrip Antenna by using EM simulation software

NOTE: At least 10 experiments to be carried out during the semester

Suggested Reading:

1	M L Sisodia& G S Raghuvanshi, '*Basic Microwave Techniques and Laboratory Manual*', New Age International (P) Limited, Publishers.
2	Ramesh Garg, Prakash Bhartia, Inder Bahl and Apisak Ittipiboon '*Microstrip Antenna Design HandBook*' Artech House Publishers, 2001

Project Work(Stage -I)

PW 702 EC

Instruction: 2 periods per week *Duration of SEE: 3 hours*
CIE: 50 marks *SEE: - NA*
Credits : 1

Objectives:

1.	To enhance practical and professional skills.
2.	To familiarize tools and techniques of systematic literature survey and documentation
3.	To expose the students to industry practices and team work

Outcomes: On successful completion of the course, the students would be able to

1.	Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2.	Evaluate different solutions based on economic and technical feasibility
3.	Effectively plan a project and confidently perform all aspects of project management
4.	Demonstrate effective written and oral communication skills
5.	To encourage students to work on innovative and entrepreneurial ideas.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester.
The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
2. Grouping of students (max 3 in a group)
3. Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.
Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of internal marks which will be on the basis of performance in all the 3 items stated above. The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts
- Presentation- oral and written.

PROFESSIONAL ELECTIVE 3

COMPUTER VISION AND PATTERN RECOGNITION

PE 509 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To understand the concept of computer vision using various image formation models
2. To analyze image processing and feature extraction techniques
3. To apply the concepts of computer vision for object recognition.

Outcomes: On successful completion of the course, the students would be able to

1. To implement fundamental image processing techniques required for computer vision
2. Understand Image formation process and perform shape analysis
3. Extract features form Images and do analysis of Images and Generate 3D model from images
4. To develop applications using computer vision techniques
5. Understand video processing, motion computation and 3D vision and geometry

UNIT – I
Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality
UNIT – II
Image Formation Models : Monocular imaging system , Radiosity: The 'Physics' of Image Formation, Radiance, Irradiance, BRDF, color etc, Orthographic & Perspective Projection,• Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images
UNIT – III
Image Processing and Feature Extraction: Image preprocessing, Image representations (continuous and discrete) , Edge detection Motion Estimation : Regularization theory , Optical computation , Stereo Vision , Motion estimation , Structure from motion
UNIT – IV
Shape Representation and Segmentation : Contour based representation, Region based representation, Deformable curves and surfaces , Snakes and active contours, Level set representations , Fourier and wavelet descriptors , Medial representations , Multiresolution analysis
UNIT – V
Object recognition : Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis , Shape priors for recognition,

Pattern recognition methods, HMM, GMM and EM, Applications: Photo album – Face detection – Face recognition – Eigen faces-Active appearance and 3D shape models of faces Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis

Suggested Reading:

1	D. Forsyth and J. Ponce, '*Computer Vision - A modern approach',* Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2	E. Trucco and A. Verri, '*Introductory Techniques for 3D Computer Vision'*, Publisher: Prentice Hall
3	Simon J. D. Prince, '*Computer Vision: Models, Learning, and Inference*', Cambridge University Press, 2012
4	Mark Nixon and Alberto S. Aquado, '*Feature Extraction & Image Processing for Computer Vision',* Third Edition, Academic Press, 2012.

PROFESSIONAL ELECTIVE 3
OPTICAL COMMUNICATION

PE 510 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Learn concepts of propagation through optical fiber Fiber modes and configurations, Losses and dispersion through optical fiber.
2. Understand operating principles of light sources and detectors used in optical transmitters and Receivers.
3. Design an optical link in view of loss and dispersion.

Outcomes: On successful completion of the course, the students would be able to

1. Understand different types of optical fiber, mode theory and Signal degradation in Optical fiber
2. Identify the merits and demerits of various Optical Sources and detectors in Optical Communication
3. Identify the merits and demerits of various Optical Sources and detectors in Optical Communication
4. Know the different Components used in Optical Communication Link
5. Design WDM system with various system consideration

UNIT – I
Evolution of fiber optic system : Elements of Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview Low frequency data transportation of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.
UNIT – II
Attenuation : Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Types of OFC Connectors and issues involved Design Optimization of Single and cut-off wavelength.
UNIT – III
Direct and indirect Band gap materials : LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.
UNIT – IV
PIN and APD diodes : Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

UNIT – V
Point-to-Point link system considerations: Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM and Applications. Erbium-doped Amplifiers. Introductory concepts of SONET/SDH Network. Multiple signal interface in fibers, Bandwidth utilization, Interface with nano-electronic devices.

Suggested Reading:

1	Gerd Keiser, *'Optical Fiber Communication',*4/e, TMH, 2000.
2	J.Senior, *'Optical Communication, Principles and Practice',* PHI, 1994.
3	J.Gower, *'Optical Communication System',* PHI, 2001.
4	Binh, *'Digital Optical Communications',* First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

PROFESSIONAL ELECTIVE 3
ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

PE 511 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To understand foundations and Applications of AI
2. To learn Probabilistic Reasoning and other search algorithms.
3. To design Bayesian Networks and Markov model and aspects of Reinforcement learning

Outcomes: On successful completion of the course, the students would be able to

1. Identify problems that are amenable to solution using State space search algorithms
2. Understand and analyze working of an AI technique using Heuristic search
3. Understand and design the Bayesian Networks
4. Understand and apply the concepts of Markov Decision process.
5. Apply of AI concepts to Reinforcement Learning

UNIT – I
Overview and Search Techniques: Introduction to AI, Problem Solving, State space search, Blind search: Depth first search, Breadth first search, Informed search: Heuristic function, Hill climbing search, Best first search, A* & AO* Search, Constraint satisfaction problem; Game tree, Evaluation function, Mini-Max search, Alpha-beta pruning, Games of chance.
UNIT – II
Knowledge Representation (KR): Introduction to KR, Knowledge agent, Predicate logic, Inference rule & theorem proving forward chaining, backward chaining, resolution; Propositional knowledge, Boolean circuit agents; Rule Based Systems, Forward reasoning: Conflict resolution, backward reasoning: Structured KR: Semantic Net - slots, inheritance, Conceptual Dependency
UNIT – III
Handling uncertainty and Learning: Source of uncertainty, Probabilistic inference, Bayes' theorem, Limitation of naïve Bayesian system, Bayesian Belief Network (BBN); Machine learning, Basic principal, Utility of ML Well defined learning system, Challenges in ML, Application of ML.
UNIT – IV
Learning and Classifiers: Linear Regression (with one variable and multiple variables), Decision Trees and issue in decision tree, Clustering (K-means, Hierarchical, etc), Dimensionality reduction, Principal Component Analysis, Anomaly detection, Feasibility of learning, Reinforcement learning.
UNIT – V
Artificial Neural Networks: Introduction, Artificial Perceptron's, Gradient Descent and The Delta Rule, Adaline, Multilayer Networks, Back-propagation Rule back-propagation Algorithm- Convergence; Evolutionary algorithm, Genetic Algorithms – An Illustrative Example, Hypothesis Space Search, Swarm intelligence algorithm.

Suggested Reading:

1	Stuart Russell and Peter Norvig, ―Artificial Intelligence: A Modern Approach , 3rd Edition, Prentice Hall
2	Artificial Intelligence by Elaine Rich and Kevin Knight, Tata MeGraw Hill
3	Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press
4	Artificial Neural Network, B. Yegnanarayana, PHI, 2005

PROFESSIONAL ELECTIVE 3
FUZZY LOGIC AND APPLICATIONS

PE 512 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 4

Objectives:

1. The concepts of regular sets and Fuzzy sets and fuzzy relations
2. Different Fuzzification methods & Membership function
3. Fuzzy Associative Memories, FAM system Architecture & its applications

Outcomes: On successful completion of the course, the students would be able to

1. To distinguish crisp sets & Fuzzy sets and perform operations on Fuzzy sets
2. Define Fuzzy relations & apply operations on different Fuzzy relations
3. To convert crisp sets to Fuzzy sets using different Fuzzification methods
4. To convert Fuzzy sets to Crisp sets using different Defuzzification methods
5. To understand Fuzzy Associative Memories & FAM system Architecture

UNIT – I
Basics of Fuzzy sets: Introduction to Fuzzy sets, Operation on Fuzzy sets, Properties of Fuzzy sets, Extensions of Fuzzy set concepts, Extension principle and its applications.
UNIT – II
Fuzzy *Relations*: Basics of fuzzy relations, Operations on fuzzy relations, Properties of Fuzzy relations, Fuzzy Equivalence & Fuzzy Tolerance relations, Various types of Binary fuzzy relations.
UNIT – III
***Membership Functions*:** Features of the membership function, Fuzzification, Membership value assignments: Intuition, Inference, Rank ordering, Neural Networks.
UNIT – IV
Defuzzification, Different Defuzzification methods: Max-membership principle, Central method, weighted average method, Mean-max membership, Center of sums, Center of largest area, First (or last) of maxima.
UNIT – V
***Fuzzy Associative Memories*:** FAMs as Mappings, Fuzzy Hebb FAMS, Bi-directional FAM theorem for Correlation-Minimum Encoding, Correlation-Product Encoding, Superimposing FAM rules, FAM system Architecture, Example of Invented pendulum, Basic structure and operation of Fuzzy logic control system, Applications of Fuzzy controllers.

Suggested Reading:

1	Timothy J. Ross, '*Fuzzy Logic with Engineering Applications*', McGraw Hill, 1995.
2	C.T. Lin and C.S.George Lee, '*Neural Fuzzy Systems*', PHI, 1996.
3	Bant A KOSKO, '*Neural Netvorks and Fuzzy Systems*', PHI, 1994.
4	John Harris, '*Introduction to fuzzy logic applications*', Springer, 2000.

Professional Elective 4
IC VERIFICATION USING SYSTEM VERILOG

PE 513EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Understand about Verification and System Verilog as tool Gain knowledge about using the System Verilog Tool.
2. Learning the concept of OOP in verification Using the concept of OOP classes, connections and coding.
3. Learn verification techniques with an example

Outcomes: On successful completion of the course, the students would be able to

1. Understand the evolution and importance of System Verilog
2. Familiarize with the System Verilog tools
3. Apply the concepts of OOP in verification
4. Programming using the concepts of OOP classes, connections and coding.
5. Apply verification techniques

UNIT – I
Introduction to functional verification languages, Introduction to System Verilog, System Verilog data types, System Verilog procedures, Interfaces and modports, System Verilog routines.
UNIT – II
Introduction to object oriented programming, Classes and Objects, Inheritance, Composition, Inheritance v/s composition.
UNIT – III
Virtual methods. Parameterized classes, Virtual interface, Using OOP for verification, System Verilog Verification Constructs.
UNIT – IV
System Verilog Assertions: Introduction to assertion, Overview of properties and assertion, Basics of properties and sequences, Advanced properties and sequences, Assertions in design and formal verification, some guidelines in assertion writing.
UNIT – V
Coverage Driven Verification and functional coverage in SV: Coverage Driven Verification, Coverage Metrics, Code Coverage, Introduction to functional coverage, Functional coverage constructs, Assertion Coverage, Coverage measurement, Coverage Analysis SV and C interfacing: Direct Programming Interface (DPI)

Suggested Reading:

1	Sutherland, Stuart, David mann, Simon, Flake, '*System Verilog for Design*: *A Guide to Using System Verilog for Hardware Design and Modeling',* Peter2nd ed., 2006
2	Chris Spear, *'SystemVerilog for Verification: A Guide to Learning the Testbench Language* Features', 2006

3	J. Bhasker, '*System Verilog Primer*', B.S. Publication, 2013
4	Mintz, Mike, Ekendahl, Robert "*Hardware Verification with System Verilog": An Object-Oriented Framework* 2007
5	Ashok B Mehte, '*SystemVerilog Assertions and Functional Coverage*: Guide to Language, Methodology and Applications', Spinger, 2013.

Professional Elective 4
EMBEDDED SYSTEM DESIGN

PE 514 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.	Understand embedded systems, hardware and software components and design process and be able to list the RISC features of ARM core and study its architecture and instruction set.
2.	Acquire the knowledge about serial, parallel bus communication protocols and internet enabled systems-network protocols. To know the embedded system development process and different techniques for downloading embedded firmware into hardware.
3.	Familiarize with the different IDEs for firmware development for different family of processors/controllers and learn about different tools and techniques for embedded hardware debugging.

Outcomes: On successful completion of the course, the students would be able to

1.	Understand the fundamentals of the embedded system design
2.	Enumerate the instruction set of ARM Processor by studying the architecture of ARM core
3.	Acquire knowledge on the serial, parallel and network communication protocols.
4.	Learn the embedded system design life cycle and co-design issues.
5.	List the various embedded software development tools used in the design of embedded system for various applications.

UNIT – I

***Introduction to Embedded Systems*:** Classification, Embedded Processor in a system, Embedded Hardware and Software: Processor embedded into a system, Processor selection for Embedded System, Embedded System-On–Chip, Design process in Embedded System, Characteristics and quality attributes of embedded systems, Design metrics and challenges in Embedded System design.

UNIT – II

***The Arm Processor Fundamentals and Instruction set*:** RISC concepts with ARM Processors, Registers, Current Program status register, pipeline ,Exception, Exceptions, Conditional execution, Interrupts and vector table, Core extensions, Architectural Revisions, Arm processors Families. Introduction to ARM Instruction Set, Data processing instructions, Branch instructions, Data transfer instructions, Software interrupt, and Program status register instructions.

UNIT – III

***Serial Bus Communication protocols*:** I^2C, CAN, USB, Fire wire-IEEE 1394 Bus standard, advanced serial high speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X, ARM Bus, Advanced parallel high speed buses. Internet Enabled Systems-Network protocols: HTTP, TCP/IP, Ethernet.

UNIT – IV

***Embedded Software Development Process and Tools*:** 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.
UNIT – V
***Testing Simulation and Debugging Techniques and Tools*:** 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, RTOS Characteristics, Case Study: Embedded Systems design for automatic vending machines and digital camera.

Suggested Reading:

1	Raj Kamal, '*Embedded Systems-Architecture, Programming and Design*', 2/e, TMH, 2012.
2	Shibu K V, '*Introduction to Embedded systems*', 1/e, McGraw Hill Education, 2009.
3	David E.Simon, *'An Embedded software primer',* Pearson Education, 2004.
4	Steve Furber, *'ARM System on chip Architecture',* 2/e, Pearson Education.
5	Andrew N.Sloss, Dominic Symes, Chris Wright, '*ARM SYSTEM Developer's Guide Designing and Optimizing System Software*', Elsevier 2015

Professional Elective 4
MIXED SIGNAL DESIGN

PE 515 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.	Study the mixed signal of submicron CMOS circuits and Understand the various integrated based filters and topologies
2.	Learn the data converters architecture, modeling and signal to noise ratio
3.	Study the integrated circuit of oscillators and PLLs

Outcomes: On successful completion of the course, the students would be able to

1.	Apply the concepts for mixed signal MOS circuit.
2.	Analyze the characteristics of IC based CMOS filters.
3.	Design of various data converter architecture circuits.
4.	Analyze the signal to noise ratio and modeling of mixed signals.
5.	Design of oscillators and phase lock loop circuit.

UNIT – I

Submicron CMOS Circuit Design

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

UNIT – II

Integrator Based CMOS Filters

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

UNIT – III

Data Converter Architectures

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC‘s, Successive Approximation ADC.

UNIT – IV

Data Converter Modeling And SNR

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters – Using feedback to improve SNR.

UNIT – V

Oscillators And PLL

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

Suggested Reading:

1	R.Jacob Baker, 'CMOS Mixed Signal Circuit Design', Wiley India, IEEE Press, reprint 2008.
2	R.Jacob Baker, 'CMOS Circuit Design, Layout and Simulation', Wiley India, IEEE Press, Second Edition, reprint 2009.
3	Behzad Razavi, 'Design of Analog CMOS Integrated Circuits', McGraw Hill, 33rd Re-print, 2016.

For the academic years 2020-2024

INDUSTRIAL ELECTRONICS

PE 516EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To learn techniques of Conventional dc and ac Traction ,Static converters for Traction, Illumination and Electric Heating.
2. To learn concepts of Electric Heating and Power Supplies
3. To Learn basic of Power factor Control and Motor Control

Outcomes: On successful completion of the course, the students would be able to

1. Simulate and analyze the semiconductor controlled AC and DC drive system
2. Design and develop an illumination system for domestic, industry and commercial sites.
3. Design an electric heating system for industrial purposes.
4. Equip the skill to design and development of regulated power supply
5. Simulate and analyze the series and shunt compensators for power factor improvement in drive system.

UNIT – I
Conventional DC and AC Traction: Electric traction services, Nature of traction load, Coefficient of adhesion, Load sharing between traction motors, Main line and suburban train configurations, Calculation of traction drive rating and energy consumption. Important features of traction drives, Conventional DC and AC traction drives, Diesel electric traction.
UNIT – II
Static converters for Traction: Semi-conductor converter controlled drive for AC traction, Semiconductor chopper controlled DC traction. Illumination: Nature of light, Basic laws of illumination, Light sources and their characteristics, Light production by excitation and ionization, In candescence and fluorescence, Different types of lamps, Their construction, Operation and characteristics, Applications, Latest light sources, Design of illumination systems.
UNIT – III
Electric Heating: Introduction to electric heating, Advantages of electric heating, Resistance heating, Temperature control of furnaces, Induction and dielectric heating. Power Supplies: Performance parameters of power supplies, Comparison of rectifier circuits, Filters, Regulated power supplies, Switching regulators, Switch mode converter.
UNIT – IV
Power factor Control: Static reactive power compensation, Shunt reactive power compensator, Application of static SCR controlled shunt compensators for load compensation, Power factor improvement and harmonic control of converter fed systems, Methods employing natural and forced commutation schemes, Methods of implementation of forced commutation.
UNIT – V
Motor Control: Voltage control at constant frequency, PWM control, Synchronous tap changer, Phase control of DC motor, Servomechanism, PLL control of a DC motor.

Suggested Reading:

1	Dubey, G.K., '*Power Semiconductor Controlled Drives'*, Prentice Hall inc. (1989).
2	Paul, B., '*Industrial Electronicand Control*',Prentice Hallof India Private Limited(2004)
3	M.D. Murphy, F.G. Turnbull, '*Power Electronic Controlof Ac Motors'*, Pergamon (1990).
4	Sen, P.C., '*Thyristor DC Drives"*, John Wileyand Sons (1981).

For the academic years 2020-2024

SCHEME OF INSTRUCTION & EXAMINATION
B.E. VIII- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No.	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact	CIE	SEE	Duration in	
Theory Course										
1	PE 5XX EC	Professional Elective 5	3	-	-	3	30	70	3	3
2	PE 5XX EC	Professional Elective 6	3	-	-	3	30	70	3	3
3	OE 6XX YY	Open Elective 4	3	-	-	3	30	70	3	3
Practical/Laboratory Course										
4	PW 703 EC	Project stage-II (Seminar)	-	-	16	16	50	100	-	8
Total			**9**	**-**	**16**	**25**	**140**	**310**	**25**	**17**

PE: Professional Elective **OE:** Open Elective **PW:** Project Work

L: Lecture **T:** Tutorial **P:** Practical **D:** Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination (Univ. Exam)

EC: Electronics and Communication Engineering

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

Professional Elective-5		
S.No.	**Course Code**	**Course Title**
1.	PE 517 EC	Speech Processing
2.	PE518EC	Wireless sensor networks
3.	PE519EC	Data Sciences
4.	PE520EC	Radar Systems

Professional Elective-6		
S.No.	**Course Code**	**Course Title**
1.	PE521EC	Design of Fault Tolerant Systems
2.	PE522EC	Real Time Operating systems
3.	PE523EC	Scripting Languages
4.	PE524EC	Advance Digital Signal Processing

Project Work - Stage II

PW 703 EC

Instruction: 16 periods per week *Duration of SEE:3 hours*
CIE: 50 marks *SEE: 100 marks*
Credits : 8

Objectives:

1.	To enhance practical and professional skills.
2.	To familiarize tools and techniques of systematic literature survey and documentation
3.	To expose the students to industry practices and team work

Outcomes: On successful completion of the course, the students would be able to

1.	Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to the real-world problems.
2.	Evaluate different solutions based on economic and technical feasibility
3.	Effectively plan a project and confidently perform all aspects of project management
4.	Demonstrate effective written and oral communication skills
5.	To encourage students to work on innovative and entrepreneurial ideas.

The aim of Project work –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project.

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of internal marks. Internal marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: One period of contact load will be assigned to each project guide per project.

Professional Elective 5

Speech Processing

PE 517 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Understand the basic mechanism of human speech production and digital representation of speech waveforms.
2. Understand Short-time analysis and Synthesis techniques.
3. Understand Speech Synthesizes and the various problems with Automatic speech recognition.

Outcomes: On successful completion of the course, the students would be able to

1. Able to grasp the basic mechanism of human speech production.
2. Able to understand digital representation of speech waveforms.
3. Able to do Short-time analysis and Synthesis techniques.
4. Able to analyze Speech Synthesizers.
5. understand the various problems with Automatic speech recognition

UNIT – I
Introduction to Speech Processing: The mechanism of Speech production, Acoustic Phonetics, Source-Filter model of speech production. Representation of Speech waveforms: Delta modulation, Adaptive delta modulation, Differential PCM, Adaptive differential PCM.
UNIT – II
***Time-domain models for Speech processing*:** Short -Time Energy function, Zero crossing rate, End point detection, Pitch Period Estimation, Vector quantization. Format Tracking
UNIT – III
***Speech Signal Analysis*:** Short-Time Fourier analysis**,** Auto correlation function, Linear Predictive Analysis, Pitch Synchronous Analysis. Homomorphic Speech Processing: The Complex Cepstrum of Speech and its properties, Applications of Cepstral Processing
UNIT – IV
***Speech Synthesis*:** Format Synthesis, Linear Predictive Synthesis, Introduction to Text-to-speech, Articulatory speech synthesis. Speech Coders: Sub-band coding, Transforms coding, Channel decoder, Formant decoder, Linear Predictive decoder, Vector Quantizer coder.
UNIT – V
***Automatic Speech Recognition*:** Problems in Automatic speech Recognition, Dynamic warping, Hidden Markov models, Speaker Identification / verification

Suggested Reading:

1	L R Rabiner & R W Schafer, *'Digital Processing of Speech Signals'*, PHI, 1978.
2	F J Owens, '*Signal Processing of Speech*', Macmillan, 2000.
3	Papamchalis, '*Practical Approaches to Speech Coding*', PHI, 1987. Thomas
4	Daniel Jurefskey & Jemes H. Martin, '*Speech and Language Processing*', Pearson Education, 2003.
5	W. Parsons, '*Voice and Speech Processing*', Mc GRAWHILL, 1986

Professional Elective 5

WIRELESS SENSOR NETWORKS

PE 518 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.	To understand the architecture of WSN node and network
2.	To evaluate various MAC, routing and security protocols.
3.	To identify the various wireless sensor network platforms and simulators.

Outcomes: On successful completion of the course, the students would be able to

1.	Compare and contrast ad hoc and wireless sensor networks and be able to describe existing applications of wireless sensor networks.
2.	Explain single node and network architecture related concepts.
3.	Illustrate various protocols for MAC, routing and security.
4.	Analyze control, clustering, time synchronization, localization and positioning, sensor tasking and control, distinguish between the various hardware, software platforms that exist for sensor networks
5.	Identify the attacks on different layers of WSN and the defence mechanisms used against them.

UNIT – I
Introduction: Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks
UNIT – II
Single-Node Architecture : Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.
UNIT – III
Physical Layer**:** Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, Zigbee: IEEE 802.15.4 MAC Layer, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.
UNIT – IV
Topology Control: Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control. Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.
UNIT – V

Security : Architectures, Survey of Security protocols for Wireless sensor Networks and their Comparisions.

Suggested Reading:

1	Holger Karl and Andreas Willig, *'Protocols And Architectures for Wireless Sensor Networks',* John Wiley, 2005.
2	Feng Zhao and Leonidas J. Guibas, *'Wireless Sensor Networks - An Information Processing Approach',* Elsevier, 2007.
3	Kazem Sohraby, Daniel Minoli, and TaiebZnati, 'Wireless Sensor Networks- Technology, Protocols and Applications', John Wiley, 2007.
4	Anna Hac, '*Wireless Sensor Network Designs*', John Wiley, 2003.
5	Y Wang, '*A Survey of Security issues in Wireless sensor Networks*',IEEE Communications Survey and Tutorials, 2006.

Professional Electives - 5
DATA SCIENCES

PE 519EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To understand the concepts of Data science and use of Python programming for data analysis
2. To familiarize with fundamental mathematical concepts involved in data science and machine learning
3. To study application of Data science in solving real world problems.

Outcomes: On successful completion of the course, the students would be able to

1. Demonstrate understanding of the mathematical foundations needed for data science.
2. Collect, explore, clean, munge and manipulate data.
Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic 3. regression, decision trees, neural networks and clustering.
4. Build data science applications using Python based toolkits.
5.

UNIT – I
Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting **Introduction to Programming Tools for Data Science** Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK
UNIT – II
Data Visualisation: Bar Charts, Line Charts, Scatterplots **Working with data:** Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs), Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction
UNIT – III
Mathematics for Data Science: **Linear Algebra:** Vectors, Matrices, **Statistics:** Describing a Single Set of Data, Correlation, Simpson's Paradox, Correlation and Causation Probability: Dependence and Independence, Conditional Probability, Bayes's Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem, Hypothesis **Inference:** Statistical Hypothesis Testing, Confidence Intervals, P-hacking, Bayesian Inference
UNIT – IV
Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net),
UNIT – V

Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks- Learning And Generalization, Overview of Deep Learning. **Case Studies of Data Science Application** Weather forecasting, Stock market prediction, Object recognition, Real Time Sentiment Analysis.

Suggested Reading:

1	Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2	Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
3	Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.
4	Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media

Professional Electives - 5
RADAR SYSTEMS

PE 520EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. To understand RADAR system block diagram, applications and develop range equation.
2. To study various parameters used to enhance range prediction such as receiver noise, noise temperature, integration of pulses etc.
3. To understand the concept of CW radar and learn its variations, to study various types of displays in radar systems.

Outcomes: On successful completion of the course, the students would be able to

1. Explain basics of RADAR system and will able to develop radar range equation. Illustrate the importance of various parameters in enhanced range estimation for accurate prediction
2. Illustrate various types of radars such as CW radar and their variations and displays in radar
3. Explain types of MTI radar and non-coherent MTI radar
4. Illustrate on radar tracking methods and differences among them
5. Explain search radars and various antennas used in radars

UNIT – I
Radar Systems: Description of basic radar system and its elements, Radar equation, Block diagram and operation of a radar, Radar frequencies, Application of Radar, Prediction of range performance, Minimum detectable signal, Receiver noise figure, Effective noise temperature, Signal to noise ratio, False alarm time and probability of false alarm, Integration of radar pulses, Radar cross-section of target, Pulse-repetition frequency and range ambiguities, System losses.
UNIT – II
CW and FMCW Radars*:* Doppler effects, CW Radar, FMCW Radar, Multiple frequency CW radar, Low noise front-ends, A-scope, B-scope, PPI Displays, Duplexers.
UNIT – III
MTI and Pulse Doppler Radar*:* MTI radar, Delay line canceller, Multiple and staggered prf, Blind speeds, Limitations to MTI performance, MTI using range gated Doppler filters, pulse Doppler radar, Non coherent radar.
UNIT – IV
Tracking Radar: Sequential lobing, Conical scan, Mono-pulse-amplitude comparison and phase comparison methods, Tracking in range and in Doppler, Acquisition, comparison of trackers.
UNIT – V
Search Radar: Range equation, search scans, Effect of surface reflection, Line of Sight (LOS), propagation effects, Environmental noise. Radar Antennas: Antenna parameters- Parabolic reflector antennas, Cassegrain antenna, Cosecant - squared Antenna pattern.

Suggested Reading:

1.	Skolnik, Merrill I, '*Introduction to Radar Systems'*, 3/e, MGH, 2002.
2.	Barton. David K, '*Modern Radar System Analysis'*, 1/e, Aretech House, 2004.
3.	Peebles PZ, '*Radar Principles'*, John – Willey, 2004.

For the academic years 2020-2024

Professional Elective 6

DESIGN OF FAULT TOLERANT SYSTEMS

PE 521EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. Gain the basic concepts and metrics of reliable systems and able to comprehend the methods involved in testing of circuits.
2. Appreciating the techniques involved in developing reliable and fault tolerant modules using redundancy and Gain insight into practical applications of reliable systems.
3. Study testability, built–in-test & self-test concepts.

Outcomes: On successful completion of the course, the students would be able to

1. Apply the metrics like MTBF, MTTR and Availability to calculate reliability of a system.
2. Acquire knowledge on conventional test generation techniques to test combinational and sequential logics.
3. Gain the knowledge on techniques involved in developing reliable and fault tolerant modules using redundancy.
4. Acquire knowledge on practical applications of reliable systems.
5. Apply design for testability (DFT) techniques to improve observability and controllability of circuits and gain knowledge on built–in-test & self-test concepts.

UNIT – I
Basic concepts of Reliability: Failures and faults, Reliability and failure rate, Relation between reliability & mean time between failure, Maintainability & Availability, reliability of series and parallel systems. Modeling of faults. Test generation for combinational logic Circuits: conventional methods-path sensitization & Boolean difference. Random testing- transition count testing and signature analysis.
UNIT – II
Fault Tolerant Design-I: Basic concepts ,static,(NMR and use of error correcting codes), dynamic, hybrid and self purging redundancy, Sift-out Modular Redundancy (SMR), triple modular redundancy, SMR reconfiguration
UNIT – III
Fault Tolerant Design-II: Time redundancy, software redundancy, fail-soft operation, introduction to fault tolerant design of VLSI chips. Self checking circuits: Design of totally self checking checkers, checkers using m-out of n codes, self totally checking PLA design.
UNIT – IV
Design for testability: Ad-hoc methods, Full scan design, Partial scan design, Boundary scan Built-in self-test: RAM BIST Logic BIST Random and weighted random pattern testability BIST Pattern generator and response analyzer, Scan-based BIST architecture Test point insertion for improving random testability.
UNIT – V
Test Data Compression: Test stimulus compression Test response compaction, IDDQ testing s IDDQ detect defects, IDDQ test patterns, IDDQ measurement, Case studies, Design for IDDQ testability.

Analog/Mixed-signal testing: Measurement DSP-based testing, IEEE 1149.4 High-speed IO testing.

Suggested Reading:

1	Parag K. Lala, '*Fault Tolerant & Fault Testable Hardware Design*',PHI, 1985
2	Parag K. Lala, "Digital systems Design using PLD's", PHI 1990.
3	N.N. Biswas, "Logic Design Theory", PHI 1990.
4	Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen "*Test Principles and Architectures: Design for Testability"* Elsevier, 14-Aug-2006.
5	Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, '*Digital Systems Testing and Testable Design'*, John Wiley & Sons Inc 1990

For the academic years 2020-2024

Professional Elective 6

REAL TIME OPERATING SYSTEMS

PE 522 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. The functions performed by an Operating systems
2. To differentiate between real time systems and study the scheduling algorithms and concepts of process synchronization
3. The concepts of VxWorks and the fundamental concepts of UNIX operating system

Outcomes: On successful completion of the course, the students would be able to

1. Classify various types of kernels and operating systems
2. Analyze various scheduling algorithms related to RTOS.
3. Summarize the Inter process communication tools.
4. Understand the elementary concepts of Vxworks

UNIT – I
Structures of Operating System: Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures, Operating system objectives and functions, Virtual Computers, Interaction of OS and Hardware architecture, Evolution of operating systems, Batch, multi programming, Multitasking, Multiuser, parallel, distributed and real-time OS.
UNIT – II
Hard versus Soft Real-Time System: Jobs and Processors, release time, deadlines, and timing constraints, hard and soft timing constraints, hard real time systems, Uniprocessor Scheduling: Types of scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread scheduling, Multiprocessor scheduling concept, Real Time scheduling concept.
UNIT – III
Concurrency: Principles of Concurrency, Mutual Exclusion H/W Support, Software approaches, Semaphores and Mutex, Message passing, Monitors, Classical problems of Synchronization: Readers-Writers problem, Producer Consumer problem, Dining Philosopher problem. Deadlock: Principles of deadlock, Deadlock prevention, Deadlock Avoidance, Deadlock detection, An Integrated Deadlock Strategies.
UNIT – IV
Elementary Concepts of VxWorks: Multitasking, Task State Transition, Task Control – Task Creation and Activation, Task Stack, Task Names and IDs, Task Options, Task Information, Task Deletion and Deletion Safety. Memory Management – Virtual to Physical Address Mapping. Comparison of RTOS – VxWorks, μC/OS-II and RT Linux for Embedded Applications.
UNIT – V
***UNIX Kernel* :** File System, Concepts of –Process, Concurrent Execution & Interrupts. Process Management – forks & execution. Basic level Programming with System calls, Shell programming and filters, UNIX Signals, POSIX Standards

Suggested Reading:

1.	Andrew S. Tanenbaum, ' *Modern Operating Systems*', 4/e, Pearson Edition,2014. Jane W.S.Liu, "Real Time Systems," 1/e, Pearson Education, Asia, 2002.
2.	Jean J Labrose, '*Embedded Systems Building Blocks Complete and Ready-to-use Modules in C*', 2/e, CRC Press 1999.
3.	Karim Yaghmour, Jon Masters, Gilad Ben-Yesset, Philippe Gerum, '*Building Embedded Linux Systems'*, 2/e,O' Reilly Media, 2008
4.	Wind River Systems, '*VxWorks Programmers Guide 5.5*', Wind River Systems Inc.2002

Professional Elective 6

SCRIPTING LANGUAGES

PE 523 EC

Instruction: 3periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1. This course introduces the script programming paradigm.
2. Introduces scripting languages such as Perl, Ruby and TCL
3. Learning TCL ,TK and JavaScript

Outcomes: On successful completion of the course, the students would be able to

1. Comprehend the differences between typical scripting languages and typical system and application programming languages.
2. Gain knowledge of the strengths and weakness of Perl, TCL and Ruby;
3. Gain knowledge in select an appropriate language for solving a given problem.
4. Acquire programming skills in scripting language.
5. Acquire knowledge in TCL, TK and JavaScript.

UNIT – I
Introduction to Scripts and Scripting: Characteristics and uses of scripting languages, Introduction to PERL, Names and values, Variables and assignment, Scalar expressions, Control structures, Built in functions, Collections of Data, Working with arrays, Lists and hashes, Simple input and output, Strings, Patterns and regular expressions, Subroutines, Scripts with arguments.
UNIT – II
Advanced PERL: Finer points of Looping, Subroutines, Using Pack and Unpack, Working with files, Navigating the file system, Type globs, Eval, References, Data structures, Packages, Libraries and modules, Objects, Objects and modules in action, Tied variables, Interfacing to the operating systems, Security issues.
UNIT – III
The TCL phenomena, Philosophy, Structure, Syntax, Parser, Variables and data in TCL, Control flow, Data structures, Simple input/output, Procedures, Working with Strings, Patterns, Files and Pipes, Example code.
UNIT – IV
The eval, source, exec and up-level commands, Libraries and packages, Namespaces, Trapping errors, Event-driven programs, Making applications 'Internet-aware', 'Nutsand-bolts' internet programming, Security issues, running untrusted code, The C interface.
UNIT – V
TK and JavaScript: Visual tool kits, Fundamental concepts of TK, TK by example, Events and bindings, Geometry managers, PERL-TK. JavaScript – Object models, Design Philosophy, Versions of JavaScript, The Java Script core language, Basic concepts of Python. Object Oriented Programming Concepts (Qualitative Concepts Only): Objects, Classes, Encapsulation, Data Hierarchy.

Suggested Reading:

1	David Barron, '*The World of Scripting Languages*', Wiley Student Edition, 2010.
2	Brent Welch, Ken Jones and Jeff Hobbs, '*Practical Programming in Tcl and Tk*', Fourth edition.
3	Herbert Schildt, '*Java the Complete Reference*', 7th Edition, TMH.
4	Clif Flynt, '*Tcl/Tk: A Developer's Guide*', 2003, Morgan Kaufmann Series.
5	Bert Wheeler, '*Tcl/Tk 8.5 Programming Cookbook*', 2011, Packt Publishing Limited.

Professional Elective 6

ADVANCE DIGITAL SIGNAL PROCESSING

PE 524 EC

Instruction: 3 periods per week *Duration of SEE: 3 hours*
CIE: 30 marks *SEE: 70 marks*
Credits : 3

Objectives:

1.	To Comprehend characteristics of discrete time signals and systems
2.	To analyze and process signals using various transform techniques
3.	To identify various factors involved in design of digital filters

Outcomes: On successful completion of the course, the students would be able to

1.	Analyze and process signals in the discrete domain
2.	Design filters to suit specific requirements for specific applications
3.	Perform statistical analysis and inferences on various types of signals
4.	Design multi rate signal processing of signals through systems.
5.	Analyze binary fixed point and floating-point representation of numbers and arithmetic operations

UNIT – I

Digital Filter Structures: Block diagram representation – Equivalent Structures – FIR and IIR digita filter Structures AII pass Filters-tunable IIR Digital Sine-cosine generator- Computational complexity of digital filter structures.

UNIT – II

Digital Filter Design: Preliminary considerations- Bilinear transformation method of IIR filter design – design of Low pass high-pass – Band-pass, and Band stop- IIR digital filters – Spectral transformations of IIR filters – FIR filter design –based on Windowed Fourier series – design of FIR digital filters with least – mean square-error – constrained Least –square design of FIR digital filters

UNIT – III

DSP Algorithm Implementation: Computation of the discrete Fourier transform- Number representation – Arithmetic operations – handling of overflow – Tunable digital filters – function approximation

UNIT – IV

Analysis Of Finite Word Length Effects: The Quantization process and errors-Quantization of fixed –point and floating –point Numbers – Analysis of coefficient Quantization effects – Analysis of Arithmetic Round-off errors- Dynamic range scaling – signal –to- noise in Low – order IIR filters- Low – Sensitivity Digital filter – Reduction of Product round-off errors feedback – Limit cycles in IIR digital filter – Round – off errors in FFT Algorithms

UNIT – V

Power Spectrum Estimation: Estimation of spectra from Finite Duration Observations signals- Nonparametric methods for power spectrum Estimation- parametric method for power spectrum Estimation- Estimation of spectral form-Finite duration observation of signals- Non-parametric methods for power spectrum estimation – Walsh methods – Blackman and torchy method.

Suggested Reading:

1	Digital Signal Processing principles –algorithms and Applications- john G. Proakis – PHI – 3rd edition 2002.
2	Digital Time Signal Processing: Alan V. Oppenheim, Ronald W ,Shafer – PHI 1996 1st Edition reprint
3	Advanced Digital Signal Processing – Theory and Applications – Glenn Zelniker, Fred J. Taylor.