Syllabus and Scheme

B.Tech. in Electronics & Communication Engineering

(For students admitted in 2017)

SEMESTER-I & II

RAJASTHAN TECHNICAL UNIVERSITY

Scheme & Syllabus of Teaching & Examination for I year B. Tech. I Semester Effective from the session: 2017-18

		Course Title	L	T	P	Marks		
						IA	External	Total
S.N	**Subject Code**	**Theory Papers**						
1.	MA-101	Engineering Mathematics-I	3	1	0	20	80	100
2.	HU-101/ HU-103	Communication Skills / Human Values	3	0	0	20	80	100
3.	PY-101/ CY-101	Engineering Physics/ Engineering Chemistry	3	1	0	20	80	100
4.	CS-101	Computer Programming-I	3	0	0	20	80	100
5.	CE-101	Environmental Engineering and Disaster Management	3	0	0	20	80	100
		Total	15	2	0	100	400	500
		Practical						
6.	HU-102/ HU-104	Communication Skills Lab./ Human Values: Activities	0	0	2	45	30	75
7.	PY-102/ CY-102	Engineering Physics Lab/ Engineering Chemistry Lab	0	0	2	45	30	75
8.	CS-102	Computer Programming-I Lab.	0	0	2	60	40	100
9.	CE-102	Computer Aided Engineering Graphics	0	0	3	60	40	100
10.	ME-101	Mechanical Workshop Practice	0	0	2	60	40	100
11.		Discipline & Extra Curricular Activity	0	0	0	50	0	50
		Total	0	0	11	320	180	500
		Grand Total	**15**	**2**	**11**	**420**	**580**	**1000**

(Total **28** periods per week)

L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment

Scheme & Syllabus of Teaching & Examination for I year B. Tech. II Semester Effective from the session: 2017-18

		Course Title	L	T	P	Marks		
						IA	External	Total
S.N	**Subject Code**	**Theory Papers**						
1.	MA-102	Engineering Mathematics-II	3	1	0	20	80	100
2.	HU-103/ HU-101/	Human Values/ Communication Skills	3	0	0	20	80	100
3.	CY-101/ PY-101	Engineering Chemistry/ Engineering Physics	3	1	0	20	80	100
4.	CS-103	Computer Programming-II	3	0	0	20	80	100
		Elective (any two)*						
5.	EE-101	Basic Electrical and Electronics Engineering	3	0	0	20	80	100
6.	CE-103	Basic Civil Engineering						
7.	ME-102	Basic Mechanical Engineering	3	0	0	20	80	100
8.	OE-101	Engineering Mechanics						
		Total	18	2	0	120	480	600
		Practical						
9.	HU-104/ HU-102	Human Values: Activities Communication Skills Lab.	0	0	2	45	30	75
10.	CY-102/ PY-102	Engineering Chemistry Lab/ Engineering Physics Lab	0	0	2	45	30	75
11.	CS-104	Computer Programming-II Lab	0	0	2	60	40	100
12.	ME-104	Computer Aided Machine Drawing	0	0	3	60	40	100
13.		Discipline & Extra Curricular Activity	0	0	0	50	0	50
		Total	0	0	9	260	140	400
		Grand Total	**18**	**2**	**9**	**380**	**620**	**1000**

(Total **29** periods per week)
L = Lecture, **T** = Tutorial, **P** = Practical, **IA**=Internal Assessment

***Elective: The student of a particular branch will not be allowed to opt for his own branch subject.**

1. For Internal Assessment (IA) of the theory papers: Two Mid-Term Tests of 20 Marks.
2. Institute can arrange a third Mid-Term Test as per the convenience of the students.
3. Syllabus shall be prepared without units.
4. The question paper shall contain seven (07) questions of 16 marks each. The first question shall cover the entire syllabus and it shall be compulsory, it shall contain eight parts of 2 marks each, and answer to be given in about 25 words. From remaining six questions, student shall attempt any four questions.
5. Passing Rules for B.Tech. (4 Yr. Course)

The result of a candidate will be worked out at the end of each Semester Examination.

For a Pass, candidate must obtain marks for each theory.

(A)	Theory Paper	Passing%	(B)	Practical/Sessionals	Passing%
(i)	Internal Assessment	Nil	(i)	Sessional (60% component)	40%
(ii)	End Semester (B.Tech.) University Exam	35%	(ii)	Practical (40% component) University Exam	40%
(iii)	Total of (i) & (ii)	40%	(iii)	Total of (i) & (ii)	50%

Table of Contents

MA-101 ENGINEERING MATHEMATICS-I

Course Code: MA-101 Course Name: Engineering Mathematics-I
L-T-P: 3-1-0 Maximum Marks: 80

Differential Calculus:
Asymptotes (Cartesian coordinates only), concavity, convexity and point of inflection, Curve tracing (Cartesian and standard Polar curves- Cardioids, Lemniscates of Bernoulli, Limacon, Equiangular Spiral only).
Limit, continuity and differentiability of functions of two variables, Partial differentiation, Euler's theorem on homogeneous functions, change of variables, chain rule, Gradient, Directional derivative, Tangent planes and Normals.
Taylor's theorem (two variables), approximate calculations, Jacobian, maxima & minima of two and more independent variables, Lagrange's method of multipliers.

Integral Calculus:
Double integral, change of order of integration, Double integral by changing into Polar form, Applications of Double integrals for evaluating areas & volumes, triple integral; Beta function and Gamma function (simple properties).

Vector Calculus:
Scalar and vector field, differentiation & integration of vector functions: Gradient, Divergence, Curl and Differential Operator; Line, Surface and Volume integrals; Green's theorem in a plane, Gauss's and Stoke's theorem (without proof) and their applications.

Suggested Readings:

1. Thomas' Calculus, George B. Thomas, Jr., Maurice D. Weir, Joel R. Hass, Pearson Educations.
2. Calculus with Early Transcendental Functions, James Stewart, Cengage Lerning Publication.
3. Engineering Mathematics, C.B. Gupta, S.R. Singh and Mukesh Kumar, McGraw Hill Education.
4. Engineering Mathematics, S. Pal and S.C. Bhunia, Oxford University Press.
5. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education.
6. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley.

HU-101 COMMUNICATION SKILLS

Course Code: HU-101 Course Name: Communication Skills
L-T-P: 3-0-0 Maximum Marks: 80

Communication: Meaning, Importance and Cycle of Communication, Media and Types of Communication, Formal and Informal Channels of Communication, Barriers to Communication, Division of Human Communication and Methods to Improve Interpersonal Communication, Qualities of Good Communication.

Grammar: Passive Voice, Indirect Speech, Conditional Sentences, Modal Verbs, Linking Words.

Composition: Curriculum Vitae Writing, Business Letter Writing, Job Application Writing, Paragraph Writing, Report Writing.

Short Stories: 'The Luncheon' by Somerset Maugham, 'How much Land does a Man Need?' by Leo Tolstoy, 'The Night Train at Deoli' by Ruskin Bond.

Poems: 'No Men are Foreign' by James Kirkup, 'If' by Rudyard Kipling, 'Where the Mind is without Fear' by Rabindranath Tagore.

Suggested Readings:

1. Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.
2. The Written Word, Vandana Singh, Oxford University Press, India.
3. Current English Grammar and Usage with Composition, R. P. Sinha, Oxford University Press, India.
4. Rodriques M. V., 'Effective Business Communication', Concept Publishing Company, New Delhi, 1992 reprint (2000).
5. Bansal, R K and Harrison J B, 'Spoken English' Orient Longman, Hyderabad.
6. Binod Mishra & Sangeeta Sharma, 'Communication Skills for Engineers and Scientists, PHI Learning Private Ltd, New Delhi, 2011.
7. Gartside L. 'Modern Business Correspondence, Pitman Publishing, London.

HU-103 HUMAN VALUES

Course Code: HU-103 Course Name: Human Values
L-T-P: 3-0-0 Maximum Marks: 80

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education
Understanding the need, basic guidelines, content and process for Value Education
Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration
Continuous Happiness and Prosperity- A look at basic Human Aspirations
Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
Method to fulfill the above human aspirations: understanding and living in harmony at various levels

Understanding Harmony in the Human Being - Harmony in Myself
Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
Understanding the characteristics and activities of 'I' and harmony in 'I' Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
Programs to ensure Sanyam and Swasthya

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship
Understanding harmony in the Family- the basic unit of human interaction
Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti;
Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
Understanding the meaning of Vishwas; Difference between intention and competence
Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence
Understanding the harmony in the Nature
Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
Holistic perception of harmony at all levels of existence

Implications of the above Holistic Understanding of Harmony on Professional Ethics

Natural acceptance of human values
Definitiveness of Ethical Human Conduct
Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
Competence in Professional Ethics:
a) Ability to utilize the professional competence for augmenting universal human order,
b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
Case studies of typical holistic technologies, management models and production systems
Strategy for transition from the present state to Universal Human Order:
a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers

Suggested Readings:

1. R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, 2009. ISBN: 978-9-350-62091-5
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
3. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
4. R. Subramanian, Professional Ethics includes Human Values, Oxford Univ. Press.
5. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
6. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
7. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
8. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
9. A N Tripathy, 2003, Human Values, New Age International Publishers.
10. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
11. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
12. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
13. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
14. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

PY-101 ENGINEERING PHYSICS

Course Code: PY-101 Course Name: Engineering Physics
L-T-P: 3-1-0 Maximum Marks: 80

Interference of light: Michelson's Interferometer: Production of circular & straight line fringes; Determination of wavelength of light; Determination of wavelength separation of two nearby wavelengths. Optical technology: Elementary idea of anti-reflection coating and interference filters.

Diffraction and Polarization of light: Fraunhofer Diffraction at Single Slit. Diffraction grating: Construction, theory and spectrum; Determination of wavelength of light. Resolving power: Raleigh criterion; Resolving power of diffraction grating and telescope. Plane, circularly and elliptically polarized light on the basis of electric (light) vector: Malus law; Double Refraction; Phase retardation plates and their use in production and detection of circularly and elliptically polarized light; Optical activity and laws of optical rotation; specific rotation and its measurement using half-shade device.

Elements of Material Science: Bonding in solids; covalent bonding and Metallic bonding; Classification of solids as Insulators, Semiconductors and Conductors; X-Ray diffraction and Bragg's Law. Hall Effect: Theory, Hall Coefficient and applications.

Quantum Mechanics: Compton effect & quantum nature of light; Derivation of time dependent and time independent Schrodinger's Wave Equation; Physical interpretation of wave function and its properties; boundary conditions; Particle in one dimensional box.

Coherence and Optical Fibers: Spatial and temporal coherence; Coherence length; Coherence time and 'Q' factor for light; Visibility as a measure of Coherence and spectral purity; Optical fiber as optical wave guide; Numerical aperture; Maximum angle of acceptance and applications of optical fiber.

Laser and Holography: Theory of laser action; Einstein's coefficients; Components of laser; Threshold conditions for laser action; Theory, Design and applications of He-Ne and semiconductor lasers; Holography versus photography, Basic theory of holography; basic requirement of a Holographic laboratory; Applications of Holography in microscopy and interferometry.

Suggested Readings:

1. Engineering Physics: Malik and Singh (Tata McGraw Hill)
2. Engineering Physics: Naidu (Pearson)
3. Optics : Ajay Ghatak (Tata McGraw Hill)
4. Concept of Modern Phyiscs: A. Baiser (Tata McGraw Hill)
5. Fundamental of Optics : Jetkins and White (Tata McGraw Hill)
6. Material Science: Smith (McGraw Hill)

CY-101 ENGINEERING CHEMISTRY

Course Code: CY-101 Course Name: Engineering Chemistry
L-T-P: 3-1-0 Maximum Marks: 80

Water:
Common natural impurities, hardness, determination of hardness by complexometric (EDTA method), degree of hardness. Municipal water supply, requisite of drinking water, purification of water, sedimentation, filtration, sterilization, breakpoint chlorination. Water for steam making and boiler troubles, formation of solids (Scale and Sludge formation), carryover (Foaming and Priming), boiler corrosion and caustic embrittlement, Methods of boiler water treatment(water softening) preliminary treatments, preheating, Lime-Soda process, Zeolite (Permutit) process, Deionization (Demineralization) process.
Numerical problems based on hardness, Lime-Soda and zeolite process.

Organic Fuels:
Origin and classification of fuels. Solid fuels-, coal, classification of coal, significance of constituents, proximate and ultimate analyses of coal, gross and net calorific value, determination of calorific value of coal by Bomb Calorimeter. Metallurgical coke, carbonization processes- Beehive coke oven and Hoffmann Oven (by-products oven) method. Liquid fuels- Advantages of liquid fuels, petroleum and refining of petroleum, reforming, cracking, synthetic petrol, knocking, octane number, anti-knocking agents. Gaseous fuels-advantages, manufacture, composition and uses of coal gas and oil gas, determination of calorific value of gaseous fuels by Junker's calorimeter, flue gas analysis by Orsat's apparatus.
Numerical problems based on determination of calorific value (bomb calorimeter/Junkers calorimeter/Dulongs formula, proximate analysis & ultimate and combustion of fuel.

Polymers:
Classification, constituents, general properties of polymers and their uses. Preparation properties and uses of polyethylene, polyethylene terephthalate (PET), nylon 6, nylon 66, nylon 6, 10, Kevlar, Bakelite. **Elastomers** – natural rubber and vulcanization, synthetic rubbers viz. Buna-S, Buna –N, Butyl and Neoprene Rubbers. Conducting polymers-.

Lubricants:
Classification, types of lubrication, properties and uses. Viscosity and viscosity index, flash and fire point, cloud and pour point. Emulsification and steam emulsion number.

Corrosion and its control:
Definition and its significance. Mechanism of chemical (dry) and electrochemical (wet) corrosion, galvanic corrosion, concentration type corrosion and pitting corrosion. Protection from corrosion- protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.

Inorganic Engineering Materials:
Cement: Manufacture of Portland cement. Rotary kiln technology. Chemistry of hardening and setting of cement. Role of gypsum. **Refractories:** Definition properties and classification. Silica and fire clay refractories. **Glass:** Definition, type and properties of glasses. Manufacture of glass, annealing of glass. Optical fibre grade glass.

Suggested Readings:

1. Engineering Chemistry by Monica Jain and P C Jain, Dhanpat Rai Publishing Company (P) Ltd, New Delhi.
2. Engineering Chemistry Wiley, India.
3. The Chemistry and Technology of Coal, by J G Speigh, CRC Press.
4. The Chemistry and Technology of Petroleum, by J G Speigh, CRC Press.
5. Polymer Chemistry: An Introduction, Malcolm P. Stevens, Oxford University Press.
6. Lubricants and Lubrications, Theo Mang, Wilfeied, Wiley-VCH.
7. Chemistry of water treatment, Samuel Faust & Osman M Aly, CRC Press.
8. Boilers water treatment. Principles and Practice, Colin Frayne, CRC Press.
9. Corrosion Understanding the Basic, by Joseph R Davis, ASM International.
10. Engineering Chemistry, by O.G. Palanna, McGraw Hill Education, India.

CS-101 COMPUTER PROGRAMMING-I

Course Code: CS-101 Course Name: Computer Programming-I
L-T-P: 3-0-0 Maximum Marks: 80

Computer Fundamentals: Flow chart, pseudocode. binary, octal and hexadecimal number system. ASCII, EBCDIC and UNICODE. boolean operations, primary and secondary memory. Difference among low-level & high-level languages.

C Programming: Structure of a 'C' program, Datatypes, enumerated, assignment statements, input output statements, If statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement. Datatype conversion. Functions & program structure (function call and return), scope of variables, parameter passing methods, recursion v/s iteration.

Suggested Readings:

1. Fundamental of Computers By R. Thareja**,** Oxford University Press.
2. Programming in ANSI C by E Balagurusamy, Tata McGraw-Hill Education.
3. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, PHI.
4. C:The Complete Reference by Herbert Schildt, McGraw-Hill Education.
5. Let us C by Yashavant P. Kanetkar, bpb publications.

CE-101 ENVIRONMENTAL ENGINEERING AND DISASTER MANAGEMENT

Course Code: CE-101 Course Name: Environmental Engineering and Disaster Management

L-T-P: 3-0-0 Maximum Marks: 80

Basics of Environment: Environmental Pollution, Environmental Acts and Regulations, Ecosystem, Hydrological and
chemical cycles, Energy flow in ecosystems. Biodiversity, population dynamics.

Water Pollution: Water pollutants, effects of oxygen demand, water quality in lakes, reservoirs and groundwater, contaminant transport, self cleaning capacity of streams and water bodies, water quality standards, Waste water management, Treatment & disposal of wastewater.
Rain water harvesting: Reuse and saving in use of water, methods of rain water harvesting.

Solid Waste Management: Classification of solid waste, Collection, transportation, treatment, and disposal of solid waste. Economic recovery of solid waste. Sanitary landfill, on site sanitation. Energy interaction from solid waste.

Air and Noise Pollution: Primary and Secondary air pollutants, Air Pollution, Harmful effects of Air Pollution, Control of Air Pollution. Noise Pollution, Harmful effects of noise pollution, control of noise pollution, Global warming, Acid rain, Ozone depletion, Green House effect

Natural Disasters: Hydro-meteorological Based Disasters like Flood, Flash Flood, Cloud Burst, Drought, Cyclone, Forest Fires; Geological Based Disasters like Earthquake, Tsunami, Landslides, Volcanic Eruptions. Man made Disasters: Chemical Industrial Hazards, Major Power Break Downs, Traffic Accidents, Fire Hazards, Nuclear Accidents. Disaster profile of Indian continent. Study of recent major disasters. Disaster Management Cycle and its components.

Disaster Management: Understanding Disasters and Hazards and related issues social and environmental. Risk and Vulnerability. Types of Disasters, their occurrence/ causes, technical terminology involved, impact and preventive measures.

Suggested Readings:

1. Towards Basics of Natural Disaster Reduction by Prof. D.K. Sinha. Researchco Book Center,Delhi.
2. Understanding Earthquake Disasters by Amita Sinvhal. Tata McGraw Hill, New Delhi.
3. Selected Resources available on www.nidmindia.nic.in
4. Basic Environmental Engineering by Prof. R.C. Gaur, New Age International Publication.

HU-102 COMMUNICATION SKILLS LAB

Course Code: HU-102 Course Name: Communication Skills Lab.
L-T-P: 0-0-2 Maximum Marks: 75

1. Phonetic Symbols and Transcriptions
2. Extempore
3. Group Discussion
4. Dialogue Writing
5. Listening Comprehension
6. Word Formation
7. Synonyms and Antonyms
8. Affixes

(Note: Wherever appropriate, Language Lab Software is to be used to improve listening comprehension and speaking skills.)

Suggested Readings:

1. Technical Communication: principles and Practice, Meenakshi Raman & Sangeeta Sharma, Oxford University Press, India.
2. Effective Technical Communication, Barun K. Mitra, Oxford University Press, India.
3. Binod Mishra & Sangeeta Sharma, 'Communication Skills for Engineers and Scientists, PHI Learning Private Ltd, New Delhi, 2011.
4. Communication Skills, Pushplata & Sanjay Kumar, Oxford University Press, India.
5. Bhattacharya, Indrajit, An Approach to Communication Skills, Dhanpat Rai & Co. (Pvt) Ltd., New Delhi.
6. Wright, Crissy, Handbook of Practical Communication Skills, Jaico Publishing House, Mumbai.
7. Gimson, A C, 'An Introduction to the Pronunciation of English', ELBS.

PY-102 ENGINEERING PHYSICS LAB

Course Code: HU-102 Course Name: Engineering Physics Lab
L-T-P: 0-0-2 Maximum Marks: 75

1. To determine the wave length of monochromatic light with the help of Michelson's interferometer.
2. To determine the wave length of sodium light by Newton's Ring.
3. To determine the specific rotation of glucose (sugar) solution using polarimeter.
4. To determine the wave length of prominent lines of mercury by plane diffraction grating with the help of spectrometer.
5. To study the variation of a semiconductor resistance with temperature and hence determine the band gap of the semi conductor in the form of reverse baised P-N junction diode.
6. To determine the height of water tank with the help of sextant.
7. To determine the dispersive power of material of a prim for violet and yellow colour's of mercury light with the help of spectrometer.
8. To study the charge and discharge of a condenser and hence determine the same constant (both current and voltage graphs are to be plotted.
9. To verify the expression for the resolving power of a Telescope.
10. To determine the coherence length and coherence time of laser using He – Ne laser.
11. To determine the specific resistance of the material of a wire by Carey Froster's bridge.

CY-102 ENGINEERING CHEMISTRY LAB

Course Code: HU-102 Course Name: Engineering Chemistry Lab
L-T-P: 0-0-2 Maximum Marks: 75

1. To determine the hardness of water by HCL method.
2. To determine the hardness of water by EDTA method
3. Measurement of conductivity of a given sample by conductivity meter.
4. Study of Bomb Calorimeter.
5. To determine the strength of Ferrous Ammonium sulphate solution with the help of $K_2Cr_2O_7$ solution.
6. To determine the strength of $CuSO_4$ solution with the help of hypo solution.
7. To determine the strength of NaOH and Na_2CO_3 in a given alkali mixture.
8. To determine the flash and fire point of a given lubricating oil.
9. To determine the viscosity of a given lubricating oil by Redwood viscometer.
10. To determine cloud and pour point of lubricating oil.

CS-102 COMPUTER PROGRAMMING-I LAB

Course Code: CS-102 Course Name: Computer Programming-I Lab
L-T-P: 0-0-2 Maximum Marks: 100

The programs shall be developed in C language related with the following concepts:

1. Eight programs using input output statements, if statement, for loops, while loops, do-while loops, switch statement, break statement, continue statement, datatype conversion etc.
2. Check a number- palindrome, prime, etc.
3. Eight programs using functions.
4. Two programs using recursion and Iteration.

CE-102 COMPUTER AIDED ENGINEERING GRAPHICS

Course Code: CE-102 Course Name: Computer Aided Engineering Graphics
L-T-P: 0-0-3 Maximum Marks: 100

Projections of Point & Lines: Positions of Point, Notation system, systematic Approach for projections of points, Front view & Top view of point, Positions of straight lines, line parallel to Both the RPs, Line perpendicular to either of the RPs, Line inclined to one RP and parallel to the other, Line Inclined to Both the RPs, Traces of a line (One drawing sheet, one assignment in sketch book)

Projections of planes: Positions of planes, Terms used in projections of planes, plane parallel to RP, plane inclined to one RP and perpendicular to the other RP, plane perpendicular to Both the RPs, plane Inclined to Both RPs, True shape of the plane, Distance of a point from plane, Angle between two planes (no drawing sheet required, only assignment in sketch book)

Projection of solids: Basic solids, Frustums and truncated solids, Positions of the solids, solid with Axis perpendicular to an RP, solid with axis inclined to one RP and parallel to the other solid with axis Inclined to Both the RPs Solid with Axis parallel to Both the RPs (One drawing sheet, one assignment in sketch book)

Section of solids: Theory of sectioning, section of prisms and cubes, sections of pyramids and Tetrahedron section of Cylinders, Section of cones, Section of spheres (One drawing sheet, one assignment in sketch book)

Development of surfaces: Methods of development, parallel line developments, Radial line Development, Anti- Development (One drawing sheet, one assignment in sketch book)

Isometric Projection: Principle of Isometric Projection Isometric scale, Isometric projections and Isometric Views, Isometric Views of standard shapes, Isometric views of standard solids (One drawing sheet, one assignment in sketch book)

Computer Aided Drafting: Introduction to CAD, Advantages of CAD software's, Auto CAD, Auto CAD Commands and tool bars, Creating the Drawing, Charging properties, Dimensioning other object, Text editing, Isometric drawing (Four assignments on the computer)

Suggested Readings:

1. Engineering Drawing Geometrical Drawing P.S.Gill , S.K.Katara & Sons
2. Engineering Drawing,Dhanarajay A Jolhe ,Tata McGraw Hill.
3. Engineering Drawing, Basant Agarwal & CM Agarwal ,Tata McGraw Hill
4. Engineering Drawing, N.D.Bhatt, Charotar Publishing House Pvt. Ltd.
5. Engineering Drawing with an introduction to AutoCAD, Dhananjay A Jolhe
6. Engineering Drawing with AutoCAD, B.V.R. Gupta and M. Rajaroy
7. AutoCAD 2017 for Engineers & Designers (Basic and Intermediate), Sham Tickoo,

ME-101 MECHANICAL WORKSHOP PRACTICE

Course Code: ME-101 Course Name: Mechanical Workshop Practice
L-T-P: 0-0-2 Maximum Marks: 100

Carpentry Shop:
1. T – Lap joint
2. Bridle joint

Foundry Shop:
1. Mould of any pattern
2. Casting of any simple pattern

Welding Shop:
1. Lap joint by gas welding
2. Butt joint by arc welding
3. Lap joint by arc welding
4. Demonstration of brazing, soldering & gas cutting

Machine Shop Practice:
1. Demonstration of various machine tools such as Lathe, Shaper, Milling, Grinding and Drilling

Fitting Shop
1. Finishing of two sides of a square piece by filing
2. Making mechanical joint and soldering of joint on sheet metal
3. To cut a square notch using hacksaw and to drill a hole and tapping

Sheet Metal Shop

Making of Funnel using sheet metal

Suggested Readings:

1. Elements of Workshop Technology Hajra & Choudhary, Media Promoters & Publisher.
2. Workshop Practice HS Bawa, Tata McGraw Hill 2nd ed. India.
3. Mechanical Workshop Practice, K.C. John, PHI Learning New Delhi.
4. Workshop Technology, W.A.J.Chapman, CBS Publisher & Distributor New Delhi.

MA-102 ENGINEERING MATHEMATICS-II

Course Code: MA-102 Course Name: Engineering Mathematics-II
L-T-P: 3-1-0 Maximum Marks: 80

Linear Algebra:
Rank of a matrix, Normal forms, consistency of systems of linear simultaneous equations and its solutions, Linear dependence and independence of vectors, Eigen values and Eigen vectors, Cayley-Hamilton theorem (without proof), orthogonal matrices, diagonalization of matrix.

Fourier Series:
Orthogonal functions, periodic functions, Fourier series of periodic functions, Euler formula, change of intervals, Even and Odd functions, half range Fourier sine and cosine series; Harmonic analysis.

Differential Equations:
Linear differential equations of first order, Reducible to linear form, Exact differential equations, reducible to exact form; Linear Differential Equations of Higher order with constant coefficients, Simultaneous linear differential equations.
Second order linear ODE with variables coefficients, Homogenous and exact forms, Change of dependent and independent variables; Variation of parameters, Method of Undetermined coefficients, Euler-Cauchy equations.
Partial Differential Equations: Order and Degree, Formation; Linear partial differential equations of first order: Lagrange's form, Standard forms, Charpit's method.
Solutions of PDE of Second order using separation of variable method.

Suggested Readings:

1. Advanced Engineering Mathematics, Peter O Neil, Cengage Learning Publication.
2. Advanced Engineering Mathematics, 4th Edition, Dennis G. Zill, Warren S. Wright, Jones & Bartlett Publications.
3. Engineering Mathematics, S. Pal and S.C. Bhunia, Oxford University Press.
4. Engineering Mathematics, C.B. Gupta, S.R. Singh and Mukesh Kumar, McGrawHill Education.
5. Advanced Engineering Mathematics, Jain and Iyengar, Narosa Publications.
6. Higher Engineering Mathematics, B.V. Ramana, McGraw Hill Education.
7. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley.

CS-103 COMPUTER PROGRAMMING-II

Course Code: CS-103 Course Name: Computer Programming-II
L-T-P: 3-0-0 Maximum Marks: 80

Computer System Fundamentals: System software, firmware, freeware/open-source, loader, compiler, peripherals.

Computer Programming: one-dimensional arrays, multi-dimensional arrays, character arrays and strings, Pointers ,Pointers arithmetic, Dynamic memory allocation: functions like malloc, calloc, free. Preprocessor, command line arguments, difference between macro and inline function. Structure & Union, typedef. File operations and multi-file handling, sscanf()/sprintf(). Graphics using C.

Suggested Readings:

1. Programming in ANSI C by E Baluguamsamy, TaTa McGraw-Hill Education
2. Programming in C by Thareja, Oxford University Press.
3. The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, PHI.
4. C: The Complete Reference by Herbert Schildt, McGraw-Hill Education.
5. Graphics Under C by Yashavant P. Kanetkar, bpb publications.

EE-101 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Course Code: EE-101 Course Name: Basic Electrical and Electronics Engineering
L-T-P: 3-0-0 Maximum Marks: 80

Basic Concepts of Electrical Engineering: Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series-Parallel Circuits, Node Voltage Method, Mesh Current Method, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

Transformers: Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.

Alternating Quantities: Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3-Phase AC System.

Rotating Electrical Machines; DC Machines: Principle of Operation of DC Machine, EMF Equation, Applications of DC Machines. AC Machines: Principle of Operation of 3-Phase Induction Motor, 3-Phase Synchronous Motor and 3- Phase Synchronous Generator (Alternator), Applications of AC Machines.

Basic Electronics: Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behavior of PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Rectifiers, Bipolar Junction Transistor, Field Effect Transistor, Transistor as an Amplifier.

Digital Electronics: Boolean algebra, Binary System, Logic Gates and Their Truth Tables.

Electrical Measuring Instruments: PMMC instruments, shunt and series multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.

Suggested Readings:

1. Basic Electrical and Electronics Engineering by Sukhija and Nagsarkar, Oxford Publication
2. Basic Electrical & Electronics Engineering by Kothari, Nagrath, TMH
3. Basic Electrical & Electronics Engineering by V. Jagathesan, K. Vinod Kumar & R. Saravan Kumar, Wiley India.
4. Basic Electrical & Electronics Engineering by Prasad/Sivanagraju, Cengage learning Indian Edition
5. Basic Electrical and Electronics Engineering by Muthusubrmaniam, TMH
6. Fundamentals of Electrical and Electronics Engineering by Ghosh, Smarajit, PHI India
7. Basic Electrical & Electronics Engineering by Ravish Singh, TMH
8. Electrical and Electronic Technology by Edward Hughes et al, Pearson Publication

9. Basic Electrical Engineering by A.E.Fitzgerald, TMH
10. Fundamental of Electrical Engineering by Leonard S.Bobrow, Oxford

CE-103 BASIC CIVIL ENGINEERING

Course Code: CE-103 Course Name: Basic Civil Engineering
L-T-P: 3-0-0 Maximum Marks: 80

Introduction: Specialization of Civil Engineering, scope of Civil Engineering, Role of civil Engineer in Society, Impact of infrastructural development on economy of country.

Surveying: Object & principles of Surveying, plans and maps, Scales, Unit of measurement.

Linear measurements: Direct measurements- Tape & Chain, Ranging out survey lines, taking measurements of sloping ground.
Tape correction, conventional symbols. Introduction to Compass Surveying & Leveling. Introduction to total station.

Building & Building materials:
Construction materials: Stone, Brick, Cement, Mortar, Concrete, Steel – their properties & uses.
Selection of site for Buildings, types of buildings, plinth area, carpet area, floor space index, Introduction to building byelaws, concept of sun light and ventilation.
Components of Buildings & their functions, Basic concept of R.C.C., Introduction to types of foundation.

Transportation, Traffic and Road Safety: Types and characteristics of various modes of transportation, various road traffic signs, causes of accidents and road safety measures.

Suggested Readings:

1. Palancharmy, Basic Civil Engineering, McGraw Hill publishers.
2. Satheesh Gopi, Basic Civil Engineering, Pearson Publishers.
3. Ketki Ranwala Dalal, Essentials of Civil Engineering, Charotar Publishing House.

ME-102 BASIC MECHANICAL ENGINEERING

Course Code: ME-102 Course Name: Basic Mechanical Engineering
L-T-P: 3-0-0 Maximum Marks: 80

Fundamentals:

Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology.

Steam Boilers, Steam Turbines and Power Plants:
Introduction, classification and types of steam boilers and steam turbines. Discuss working of steam boilers and steam turbines.
Introduction and Classification of power plants.

Pumps and IC Engines:
Applications and working of Reciprocating and Centrifugal pumps.
Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.

Refrigeration and Air Conditioning:
Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.

Transmission of Power:
Introduction and types of Belt and Rope Drives.
Introduction to Gears and Gear Trains.

Primary Manufacturing Processes:
Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces.
Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing.
Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.
Metal Removal or Machining Processes: Introduction to machining process and various machine tools.

Engineering Materials and Heat Treatment of Steel:
Introduction to various engineering materials and their properties.
Introduction to Heat Treatment and types of Heat Treatment Processes.

Introduction to CAD, CAM, FMS, MEMS and CIM:
Introduction to modern manufacturing systems and their applications.

Suggested Readings:

1. G. Shanmugam and S Ravindran, Basic Mechanical Engieering, Mc Graw hill, fourth edition.
2. K Venu Gopal and Prabhu Raja V, Basic Mechanical Engineering, Anuradha agencies pub, Chennai.

OE-101 ENGINEERING MECHANICS

Course Code: OE-101 Course Name: Engineering Mechanics
L-T-P: 3-0-0 Maximum Marks: 80

Statics of particles and rigid bodies: Fundamental laws of mechanics, Principle of transmissibility, System of forces, Resultant force, Resolution of force, Moment and Couples, Resolution of a force into a force and a couple, Free body diagram, Equilibrium, Conditions for equilibrium, Lami's theorem.

Centroid & Moment of inertia (M.I): Location of centroid, Moment of inertia (mass and area), Parallel axis and perpendicular axis theorems, M.I of composite section, M.I. of solid bodies, Polar moment of inertia.

Virtual work: Principle of Virtual Work, Active forces and active force diagram, Stability of equilibrium.

Friction: Types of Friction, Laws of friction, Angle of friction, Angle of repose, Ladder, Wedge, Belt Friction.

Kinematics of particles and rigid bodies: Velocity, Acceleration, Types of Motion, Equations of Motion, Rectangular components of velocity and acceleration, Angular velocity and Angular acceleration, Radial and transverse velocities and accelerations, Projectiles motion on plane and Inclined Plane, Relative Motion.

Kinetics of particles and rigid bodies: Newton's second law, Equation of motion in rectangular coordinate, Equation of motion in radial and transverse components, Equation of motion in plane for a rigid body, D'Alembert principle.

Work, Energy and Power: Work of a force, weight, spring force and couple, Power, Efficiency, Energy, Kinetic energy of rigid body, Principle of work and energy, Conservative and Non-conservative Force, Conservation of energy.

Impulse and Momentum: Linear and angular momentum, Linear and angular impulse, Principle of momentum for a particle and rigid body, Principle of linear impulse and momentum for a particle and rigid body, Principle of angular momentum and Impulse, Conservation of angular momentum, Angular momentum of rigid body, Principle of impulse and momentum for a rigid body, Central impact, System of variable mass.

Suggested Readings:

1. Engineering Mechanics, Sharma, Pearson Education.
2. Engineering Mechanics, Beer and Johnston, Tata McGraw-Hill.
3. Engineering Mechanics, Basudeb Bhattacharya, Oxford University Press
4. Engineering Mechanics, Hibbeler, Pearson Education.
5. Engineering Mechanics, Meriam and Kraige, John Wiley & Sons.
6. Engineering Mechanics, Timoshenko and Young, Tata McGraw-Hill.
7. Engineering Mechanics, Shames, Pearson Education.

CS-104 COMPUTER PROGRAMMING-II LAB

Course Code: CS-104 Course Name: Computer Programming-II Lab
L-T-P: 0-0-2 Maximum Marks: 100

The programs shall be developed in C language related with the following concepts:

1. Input roll numbers of your friends in an array & print in reverse order.
2. Input names of your friends in an array & print in reverse order.
3. Input two matrices and output third matrix after performing add/subtract the corresponding elements.
4. Four programs using malloc, calloc, free & sscanf()/sprintf() functions.
5. Two programs using macro and online functions.
6. Two programs using structure & union.
7. Two programs using pointers.
8. Three programs belonging to file operations and multi-file handling.
9. Three programs belonging to graphics using C.

ME-104 COMPUTERS AIDED MACHINE DRAWING

Course Code: ME-104 Course Name: Computer Aided Machine Drawing
L-T-P: 0-0-3 Maximum Marks: 100

Introduction: Principles of drawing, conventional representation of machine components and materials, lines, types of lines, dimensioning types, rules of dimensioning.

Conversion of pictorial views into orthographic views: (1 drawing sheet) Introduction to orthographic projection, concept of first angle and third angle projection, drawing of simple machine elements in first angle projection, missing view problems.

Sectional view : (1 drawing sheet) Introduction, cutting plane line, type of sectional views-full section, half section, partial or broken section, revolved section, removed section, offset section, sectioning conventions-spokes, web, rib, shaft, pipes, different types of holes, conventions of section lines for different metals and materials.

Fasteners: (1 drawing sheet) Temporary and permanent fasteners, thread nomenclature and forms, thread series, designation, representation of threads, bolted joints, locking arrangement of nuts, screws, washers, foundation bolts etc., keys, types of keys, cotter and knuckle joints. Riveted joints, rivets and riveting, types of rivets, types of riveted joints etc.

Assembly drawing: (1 drawing sheet) Introduction to assembly drawing, assembly drawing of simple machine elements; like rigid or flexible coupling, muff coupling, plummer block, footstep bearing, bracket etc.

Free hand sketching: Need for free hand sketching, Free hand sketching of conventional representation of materials, screw fasteners, foundation bolts, studs.

Bearing: Ball, roller, needle, foot step bearing.

Coupling: Protected type, flange, and pin type flexible coupling.

Other components: Welded joints, belts and pulleys, pipes and pipe joints, valves etc.

Computer aided drafting: Concepts of computer aided 2D drafting using any drafting software like AutoCAD/ Solid works/Creo/Catia etc., basic drawing and modify commands, making 2D drawings of simple machine parts.

Suggested Readings:

1. Laxminarayan and M.L. Mathur, Machine Drawing, Jain Brothers
2. Gill P S, Machine Drawing, Kataria & Sons 2009
3. Basudeb Bhattacharya, Machine Drawing, Oxford University Press 2011
4. Dhawan, R.K., A Text Book of Machine Drawing, S. Chand & Company, 1996
5. Ostrowsky, O., Engineering Drawing with CAD Applications, ELBS, 1995
6. Siddeshswar N., P Kannaiah, VVS Shastry, Machine Drawing,Tata McGraw Hill

HU-104 HUMAN VALUES: ACTIVITIES

Course Code: HU-104 Course Name: Human Values: Activities
L-T-P: 0-0-2 Maximum Marks: 75

PS 1:

Introduce yourself in detail. What are the goals in your life? How do you set your goals in your life? How do you diffierentiate between right and wrong? What have been your salient achievements and shortcomings in your life ? Observe and analyze them.

PS 2:

Now-a-days, there is a lot of talk about many technogenic maladies such as energy and material resource depletion, environemental pollution, global warming, ozone depletion, deforestation, soil degradation, etc. - all these seem to be manmade problems, threatening the survival of life Earth - What is the root cause of these maladies & what is the way out in opininon?

On the other hand, there is rapidly growing danger because of nuclear proliferation, arms race, terrorism, breakdown of relationships, generation gap, depression & suicidal attempts etc. - what do you think, is the root cause of these threats threats to human happiness and peace - what could be the way out in your opinion?

PS 3:

1. Observe that each of us has the faculty of 'Natural Acceptance', based on which one can verify what is right or not right for him. (As such we are not properly trained to listen to our 'Natural Acceptance' and may a time it is also clouded by our strong per-conditioning and sensory attractions).

Explore the following:

(i) What is Naturally Acceptable' to you in relationship the feeling of respect or disrespect for yourself and for others?
(ii) What is 'naturally Acceptable' to you - to nurture or to exploit others?

Is your living in accordance with your natural acceptance or different from it?

2. Out of the three basic requirements for fulfillment of your aspirations - right understanding, relationship and physical facilities - observe how the problems in your family are related to each. Also observe how much time & effort you devote for each in your daily routine.

PS 4:

list down all your important desires. Observe whether the desire is related to Self (I) or the Body. If it appears to be related to both, visualize which part of it is related to Self (I) and which part is related to Body.

PS 5:

1. a. Observe that any physical facility you use, follows the given sequence with time:

Necessary and tasteful - unnecessary but still tasteful - unnecessary and tasteless - intolerable

b. In contrast, observe that any feeling in you is either naturally acceptable or not acceptable at all. If not acceptable, you want it continuously and if not acceptable, you do not want it any moment!

2. List down all your important activities. Observe whether the activity is of 'I' or of Body or with the participation of both or with the participation of both 'I' and Body.

3. Observe the activities within 'i'. Identify the object of your attention for different moments (over a period of sy 5 to 10 minutes) and draw a line diagram connecting these points. Try observe the link between any two nodes.

PS 6:

1. Chalk out some programs towards ensuring your harmony with the body - in tearms of nurturing, protection and right utilisation of the body.
2. Find out the plants and shrubs growing in and around your campus, which can be useful in curing common diseases.

PS 7:

Form small groups in the class and make them carry out a dialogue focusing on the following eight questions related to 'TRUST';

1a. Do I want to make myself happy?

2a. Do I want to make the other happy?

3a. Does the other want to make himself/herself happy?

4a. Does the other want to make me happy?

What is the answer?

Intention (Natural Acceptance)

1b. Am I able to always make myself happy?

2b. Am I able to always make the other happy?

3b. Is the other able to always make himself/herself happy?

What is the answer?

Let each student answer the questions for himself and everyone else. Discuss the difference between intention and competence. Observe whether you evaluate yourself and others on the basis of intention/competence.

PS 8:

1. Observe, on how many occasions, you are able to respect your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under-evaluation, over-evaluation or otherwise evaluation.
2. Also, observe whether your feeling of respect is based on treating the other as you would treat youself or on differentiations based on body, physical facilities or belieds.

PS 9:

1. Write a narration in the form of a story, poem, skit or essay to clarify a salient Human Value to the children.
2. Recollect and narrate an incident in your life where you were able to exhibit willful adherence to balues in a difficult situation.

PS 10:

List down some common units (things) of Nature which you come across in your daily life and classify them in the four orders of Nature. Analysis and explain the aspect of mutual fulfillment of each unit with other orders.

PS 11:

Make a chart to show the whole existence as co-existence. With the help of this chart try to identify the role and the scope of some of the courses of your study. Also indicate the areas which are being either over-emphasized or ignored in the present context.

PS 12:

Identify any two important problems being faced by the society today and analyze the root cause of these problems. Can these be solved on the basic of natural acceptance of human values. If so, how should one proceed in this direction from the present situation?

PS 13:

1. Suggest ways in which you can use your knowledge of Science/Technology/Management etc. for moving towards a universal human order.
2. Propose a broad outline for humanistic Constitution at the level of Nation.

PS 14:

The course is going to be over now. It is time to evaluate what difference in your thinking it has made. Summarize the core massage of this course grasped by you. How has this affected you in terms of;

a. Thought
b. Behavior
c. Work and
d. Relization

What practical steps are you able to visualize for the transition of the society from its present state.

Project:

Every student required to take-up a social project e.g. educating children in needy/weaker section, services in hospitals, NGO's and other such work

SEMESTER-III to VIII

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Teaching & Examination Scheme
B.Tech. : Electronics & Communication Engineering
2nd Year - III Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
THEORY											
1	BSC	3EC2-01	Advanced Engineering Mathematics-I	3	0	0	3	30	120	**150**	**3**
2	HSMC	3EC1-02/ 3EC1-03	Technical Communication/Managerial Economics and Financial Accounting	2	0	0	2	20	80	**100**	**2**
3	PCC	3EC4-04	Digital System Design	3	0	0	3	30	120	**150**	**3**
4		3EC4-05	Signal & Systems	3	0	0	3	30	120	**150**	**3**
5		3EC4-06	Network Theory	3	1	0	3	40	160	**200**	**4**
6		3EC4-07	Electronics Devices	3	1	0	3	40	160	**200**	**4**
			Sub Total	17	2	0		190	760	**950**	**19**
PRACTICAL & SESSIONAL											
8	PCC	3EC4-21	Electronics Devices Lab	0	0	2		30	20	**50**	**1**
9		3EC4-22	Digital System Design Lab	0	0	2		30	20	**50**	**1**
10		3EC4-23	Signal Processing Lab	0	0	2		30	20	**50**	**1**
11	ESC	3EC3-24	Computer Programming Lab-I	0	0	2		30	20	**50**	**1**
13	PSIT	3EC7-30	Industrial Training	0	0	1				**50**	**1**
14	SODECA	3EC8-00	Social Outreach, Discipline & Extra Curricular Activities							**25**	**0.5**
			Sub- Total	0	0	9		120	80	**275**	**5.5**
			TOTAL OF III SEMESTER	17	2	9		310	840	**1225**	**24.5**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Teaching & Examination Scheme
B.Tech. : Electronics & Communication Engineering
2nd Year - IV Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
THEORY											
1	BSC	4EC2-01	Advanced Engineering Mathematics-II	3	0	0	3	30	120	**150**	**3**
2	HSMC	4EC1-03/ 4EC1-02	Managerial Economics and Financial Accounting/ Technical Communication	2	0	0	2	20	80	**100**	**2**
3	PCC	4EC4-04	Analog Circuits	3	0	0	3	30	120	**150**	**3**
4		4EC4-05	Microcontrollers	3	0	0	3	30	120	**150**	**3**
5	ESC	4EC3-06	Electronics Measurement & Instrumentation	3	0	0	3	30	120	**150**	**3**
6	PCC	4EC4-07	Analog and Digital Communication	3	0	0	3	30	120	**150**	**3**
			Sub Total	17	0	0		170	680	**850**	**17**
PRACTICAL & SESSIONAL											
8	PCC	4EC4-21	Analog and Digital Communication Lab	0	0	3		45	30	**75**	**1.5**
9		4EC4-22	Analog Circuits Lab	0	0	3		45	30	**75**	**1.5**
10		4EC4-23	Microcontrollers Lab	0	0	3		45	30	**75**	**1.5**
11		4EC4-24	Electronics Measurement & Instrumentation Lab	0	0	3		45	30	**75**	**1.5**
12	SODECA	4EC18-00	Social Outreach, Discipline & Extra Curricular Activities							**25**	**0.5**
			Sub- Total	0	0	12		180	120	**325**	**6.5**
			TOTAL OF IV SEMEESTER	17	0	12		350	800	**1175**	**23.5**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Teaching & Examination Scheme
B.Tech. : Electronics & Communication Engineering
3rd Year –V Semester

SN	Category	Course Code	Course Title	Contact hrs/week L	T	P	Marks Exm Hrs	IA	ETE	Total	Cr
THEORY											
1	ESC	5EC 3-01	Computer Architecture	2	0	0	2	20	80	**100**	**2**
2	PCC/ PEC	5EC 4-02	Electromagnetics Waves	3	0	0	3	30	120	**150**	**3**
3		5EC 4-03	Control system	3	0	0	3	30	120	**150**	**3**
4		5EC 4-04	Digital Signal Processing	3	0	0	3	30	120	**150**	**3**
5		5EC 4-05	Microwave Theory & Techniques	3	0	0	3	30	120	**150**	**3**
6		Professional Elective I (any one)		2	0	0	2	20	80	**100**	**2**
		5EC 5-11	Bio-Medical Electronics								
		5EC 5-12	Embedded Systems								
		5EC 5-13	Probability Theory & Stochastic Process								
		5EC 5-14	Satellite Communication								
		Sub Total		**16**	**0**	**0**		**160**	**640**	**800**	**16**
PRACTICAL & SESSIONAL											
7	PCC	5EC 4-21	RF Simulation Lab	0	0	3	2	45	30	**75**	**1.5**
8		5EC 4-22	Digital Signal Processing Lab	0	0	3	2	45	30	**75**	**1.5**
9		5EC 4-23	Microwave Lab	0	0	2	2	30	20	**50**	**1**
10	PSIT	5EC 7-30	Industrial Training	0	0	1		75	50	**125**	**2.5**
11	SODECA	5EC 8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0			25	**25**	**0.5**
		Sub- Total		**0**	**0**	**9**		**195**	**155**	**350**	**7**
		TOTAL OF V SEMESTER		**16**	**0**	**9**		**355**	**795**	**1150**	**23**

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Teaching & Examination Scheme
B. Tech.: Electronics & Communication Engineering
3rd Year – VI Semester

THEORY												
SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
1	ESC	6EC 3-01	Power Electronics	2	0	0	2	20	80	**100**	**2**
2	PCC/ PEC	6EC 4-02	Computer Network	3	0	0	3	30	120	**150**	**3**
3		6EC 4-03	Fiber Optics Communications	3	0	0	3	30	120	**150**	**3**
4		6EC 4-04	Antennas and Propagation	3	0	0	3	30	120	**150**	**3**
5		6EC 4-05	Information theory and coding	3	0	0	3	30	120	**150**	**3**
6		Professional Elective II (any one)		3	0	0	3	30	120	**150**	**3**
		6EC 5-11	Introduction to MEMS								
		6EC 5-12	Nano Electronics								
		6EC 5-13	Neural Network And Fuzzy Logic Control								
		6EC 5-14	High Speed Electronics								
		Sub Total		**17**	**0**	**0**		**170**	**680**	**850**	**17**
PRACTICAL & SESSIONAL											
7	PCC	6EC 4-21	Computer Network Lab	0	0	4	2	60	40	**100**	**2**
8		6EC 4-22	Antenna and wave propagation Lab	0	0	2	2	30	20	**50**	**1**
9		6EC 4-23	Electronics Design Lab	0	0	4	2	60	40	**100**	**2**
10		6EC 4-24	Power Electronics Lab	0	0	2	2	30	20	**50**	**1**
11	SODECA	6EC 8-00	Social Outreach, Discipline & Extra Curricular Activities	0	0	0			25	**25**	**0.5**
		Sub- Total		**0**	**0**	**12**		**180**	**145**	**325**	**6.5**
		TOTAL OF VI SEMESTER		**17**	**0**	**12**		**350**	**825**	**1175**	**23.5**

L: Lecture, **T:** Tutorial, **P:** Practical, **Cr:** Credits

ETE: End Term Exam, **IA:** Internal Assessment

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

Teaching & Examination Scheme
B.Tech. : Electronics & Communication Engineering
4th Year - VII Semester

SN	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
THEORY											
1	PEC	Program Elective		3	0	0	3	30	120	**150**	**3**
		7EC5-11	VLSI Design								
		7EC5-12	Mixed Signal Design								
		7EC5-13	CMOS design								
2	OE		Open Elective-I	3	0	0	3	30	120	**150**	**3**
			Sub Total	**6**	**0**	**0**		**60**	**240**	**300**	**6**
PRACTICAL & SESSIONAL											
3	PCC	7EC4-21	VLSI Design Lab	0	0	4	2	60	40	**100**	**2**
4		7EC4-22	Advance communication lab (MATLAB Simulation)	0	0	2	2	30	20	**50**	**1**
5		7EC4-23	Optical Communication Lab	0	0	2	2	30	20	**50**	**1**
6	PSIT	7EC7-30	Industrial Training	1	0	0		75	50	**125**	**2.5**
7		7EC7-40	Seminar	2	0	0		60	40	**100**	**2**
8	SODECA	7EC8-00	Social Outreach, Discipline & Extra Curricular Activities					0	25	**25**	**0.5**
			Sub Total	**3**	**0**	**8**		**255**	**195**	**450**	**9**
			TOTAL of VII SEMESTER	**9**	**0**	**8**		**315**	**435**	**750**	**15**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

Teaching & Examination Scheme
B.Tech. : Electronics & Communication Engineering
4th Year - VIII Semester

THEORY												
SN	**Category**	**Course Code**	**Course Title**	**Contact hrs/week**			**Marks**				**Cr**
				L	**T**	**P**	**Exm Hrs**	**IA**	**ETE**	**Total**	
1	PEC		Program Elective	3	0	0	3	30	120	**150**	**3**
		8EC5-11	Artificial Intelligence And Expert Systems								
		8EC5-12	Digital Image and Video Processing								
		8EC5-13	Adaptive Signal Processing								
2	OE		Open Elective-II	3	0	0	3	30	120	**150**	**3**
			Sub Total	**6**	**0**	**0**		**60**	**240**	**300**	**6**
PRACTICAL & SESSIONAL											
3	PCC	8EC4-21	Internet of Things (IOT) Lab	0	0	2	2	30	20	**50**	**1**
4		8EC4-22	Skill Development Lab	0	0	2	2	30	20	**50**	**1**
5	PSIT	8EC7-50	Project	3	0	0		210	140	**350**	**7**
6	SODECA	8EC8-00	Social Outreach, Discipline & Extra Curricular Activities						25	**25**	**0.5**
			Sub Total	**3**	**0**	**4**		**270**	**205**	**475**	**9.5**
			TOTAL of VIII SEMESTER	**9**	**0**	**4**		**330**	**445**	**775**	**15.5**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

List of Open Electives for Electronics & Communication Engineering				
Subject Code	**Title**		**Subject Code**	**Title**
Open Elective - I			**Open Elective - II**	
7AG6-60.1	Human Engineering and Safety		8AG6-60.1	Energy Management
7AG6-60.2	Environmental Engineering and Disaster Management		8AG6-60.2	Waste and By-product Utilization
7AN6-60.1	Aircraft Avionic System		8AN6-60.1	Finite Element Methods
7AN6-60.2	Non-Destructive Testing		8AN6-60.2	Factor of Human Interactions
7CH6-60.1	Optimization Techniques		8CH6-60.1	Refinery Engineering Design
7CH6-60.2	Sustainable Engineering		8CH6-60.2	Fertilizer Technology
7CR6-60.1	Introduction to Ceramic Science & Technology		8CR6-60.1	Electrical and Electronic Ceramics
7CR6-60.2	Plant, Equipment and Furnace Design		8CR6-60.2	Biomaterials
7CE6-60.1	Environmental Impact Analysis		8CE6-60.1	Composite Materials
7CE6-60.2	Disaster Management		8CE6-60.2	Fire and Safety Engineering
7CS6-60.1	Quality Management/ISO 9000		8CS6-60.1	Big Data Analytics
7CS6-60.2	Cyber Security		8CS6-60.2	IPR, Copyright and Cyber Law of India
7EE6-60.1	Electrical Machines and Drives		8EE6-60.1	Energy Audit and Demand side Management
7EE6-60.2	Power Generation Sources.		8EE6-60.2	Soft Computing
7ME6-60.1	Finite Element Analysis		8ME6-60.1	Operations Research
7ME6-60.2	Quality Management		8ME6-60.2	Simulation Modeling and Analysis
7MI6-60.1	Rock Engineering		8MI6-60.1	Experimental Stress Analysis
7MI6-60.2	Mineral Processing		8MI6-60.2	Maintenance Management
7PE6-60.1	Pipeline Engineering		8PE6-60.1	Unconventional Hydrocarbon Resources
7PE6-60.2	Water Pollution control Engineering		8PE6-60.2	Energy Management & Policy
7TT6-60.1	Technical Textiles		8TT6-60.1	Material and Human Resource Management
7TT6-60.2	Garment Manufacturing Technology		8TT6-60.2	Disaster Management

3EC2-01: Advance Engineering Mathematics-I

3 Credits **Max. Marks: 150 (IA:30, ETE:120)**
3L:0T:0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Numerical Methods – 1:** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.	**10**
2	**Numerical Methods – 2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.	**8**
3	**Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.	**10**
4	**Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).	**7**
5	**Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.	**5**
	Total	**40**

3EC1-02/4EC1-02: Technical Communication

2 Credit **Max. Marks: 100 (IA:20, ETE:80)**
2L:0T:0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	4
2	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Readingand comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
3	**Technical Writing, Grammar and Editing**- Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
4	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	Total	**26**

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

3EC1-03/4EC1-03: Managerial Economics And Financial Accounting

2 Credit **Max. Marks: 100 (IA:20, ETE:80)**

2L:0T:0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Basic economic concepts- Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	4
2	Demand and Supply analysis- Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
3	Production and Cost analysis- Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
4	Market structure and pricing theory- Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
5	Financial statement analysis- Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	Total	**26**

3EC4-04: Digital System Design

3 Credits **Max. Marks: 150 (IA:30, ETE:120)**
3L:0T:0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.	7
2	MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU	8
3	Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of Synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation.	9
4	Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, memory elements, Concept of Programmable logic devices like FPGA. Logic implementation using programmable devices.	8
5	VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.	8
	Total	**40**

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-04	Digital System Design	CO 1	Develop the understanding of number system and its application in digital electronics.
		CO 2	Development and analysis of K-map to solve the Boolean function to the simplest form for the implementation of compact digital circuits.
		CO 3	Design various combinational and sequential circuits using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.
		CO 4	Understanding Interfacing between digital circuits and analog component using Analog to Digital Converter (ADC), Digital to Analog Converter (DAC) etc.
		CO 5	Design and implement semiconductor memories, programmable logic devices (PLDs) and field programmable gate arrays (FPGA) in digital electronics.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-04 Digital System Design	CO 1	3	2	2	1		1						
	CO 2	3	2	3	2								
	CO 3	2	2	3	1	1							
	CO 4	3	2	1	1	1							
	CO 5	2	1	3	1	1							

3: Strongly **2: Moderate** **1: Weak**

Lecture Plan:

Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Review of Boolean Algebra
Lecture 3	DeMorgan's Theorem, SOP & POS forms,
Lecture 4	Problem of SOP and POS forms of boolean functions.
Lecture 5	Simplification of karnaugh map up to 6 variables
Lecture 6	Simplification of karnaugh map up to 6 variables
Lecture 7	Simplification of karnaugh map up to 6 variables
Lecture 8	Binary codes and code conversion
Lecture 9	Binary codes and code conversion
Lecture 10	Encoder, Decoder
Lecture 11	Half and Full Adders, Subtractors, Serial and Parallel Adders
Lecture 12	BCD Adder, Barrel shifter
Lecture 13	S-R FF, edge triggered and level triggered
Lecture 14	D and J-K FF
Lecture 15	Master-Slave JK FF and T FF
Lecture 16	Ripple and Synchronous counters
Lecture 17	Other type of counters
Lecture 18	Shift registers, Finite state machines, Asynchronous FSM
Lecture 19	Design of synchronous FSM
Lecture 20	Design of synchronous FSM
Lecture 21	Design of synchronous FSM
Lecture 22	Designing synchronous circuits (pulse train generator, pseudo random binary sequence generator, clock generation)

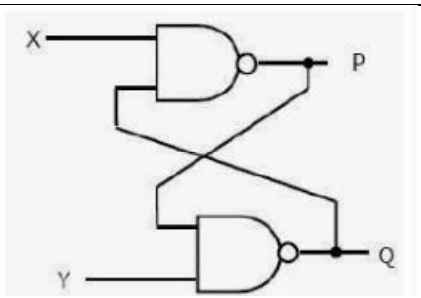
Lecture 23	TTL NAND gate, specifications, noise margin, propagation delay, fan-in, fan-out
Lecture 24	TTL NAND gate
Lecture 25	Tristate TTL, ECL
Lecture 26	CMOS families and their interfacing
Lecture 27	CMOS families and their interfacing
Lecture 28	Read-Only Memory, Random Access Memory
Lecture 29	Programmable Logic Arrays (PLA)
Lecture 30	Programmable Array Logic (PAL),
Lecture 31	Field Programmable Gate Array (FPGA)
Lecture 32	Combinational PLD-Based State Machines,
Lecture 33	State Machines on a Chip
Lecture 34	Schematic, FSM & HDL
Lecture 35	Different modeling styles in VHDL
Lecture 36	Data types and objects, Data flow
Lecture 37	Behavioral and Structural Modeling
Lecture 38	Behavioral and Structural Modeling
Lecture 39	Simulation VHDL constructs and codes for combinational and sequential circuits
Lecture 40	Simulation VHDL constructs and codes for combinational and sequential circuits

Content delivery method:

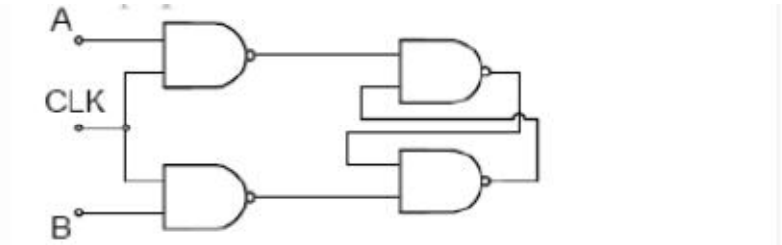
1. Chalk and Duster
2. PPT
3. Hand-outs

Sample Assignments:

Assignment 1	**Q1.** Using K-maps, find the minimal Boolean expression of the following SOP and POS representations. a. f (w,x,y,z)= Σ (7,13,14,15) b. f(w,x,y,z) = Σ (1,3,4,6,9,11,14,15) c. f(w,x,y,z) = Π(1,4,5,6,11,12,13,14,15) d. f(w,x,y,z) = Σ (1,3,4,5,7,8,9,11,15) e. f(w,x,y,z) = Π (0,4,5,7,8,9,13,15)
	Q2. Find the function h(a,b,c,d) such that f = f^d. f (a,b,c,d) = a ·b· c + (a · c + b)· d + h(a,b,c,d)
	Q3. Using K-maps of the functions f1 and f2, find the following: (provide the canonical form expression and simplify) a. T1 = f1 · f2 b. T2 = f1 + f2 c. T3 = f1 ⊕ f2 where f1(w,x,y,z) = Σ (0,2,4,9,12,15), f2(w,x,y,z) = Σ (1,2,4,5,12,13)
Assignment 2	**Q1**. Draw the state diagram of a serial adder.
	Q2. In the following circuit, given binary values were applied to the Inputs X and Y inputs of the NAND latch shown in the figure. X = 0, Y = 1; X = 0, Y = 0; X = 1, Y = 1. Find out the corresponding stable output P, Q.



Q3. When the race around condition will occur in the circuit given Below:



3EC4-05: Signals & Systems

3 Credits **Max. Marks: 150 (IA:30, ETE:120)**

3L:0T:0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.	6
2	Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations	7
3	Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases	8
4	The Laplace Transform, notion ofeigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.	6
5	The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.	5
6	State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	8
	Total	40

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-05	Signals & Systems	CO 1	Analyze different types of signals and system properties
		CO 2	Represent continuous and discrete systems in time and frequency domain using different transforms
		CO 3	Investigate whether the system is stable.
		CO 4	Sampling and reconstruction of a signal.
		CO 5	Acquire an understanding of MIMO systems

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-05 Signals & Systems	CO 1	3	3	1	2	2			1				2
	CO 2	3	1		2	3			1				2
	CO 3	3	2	2	3								2
	CO 4	3	2	3	3	1							
	CO 5	3	2	2	3	1			2				1

3: Strongly 2: Moderate 1: Weak

Lecture Plan:

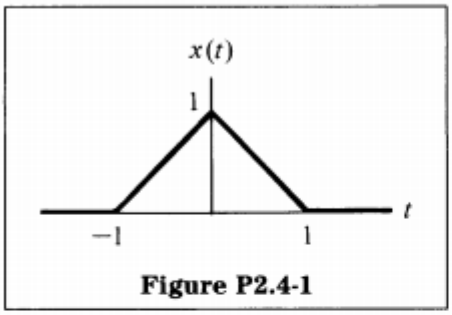
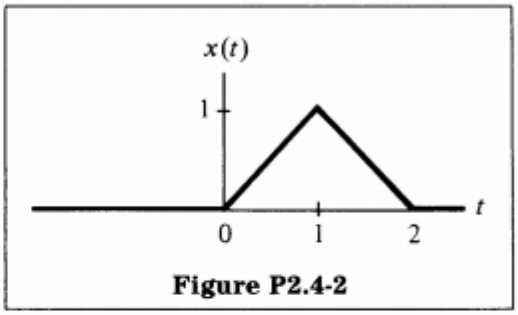
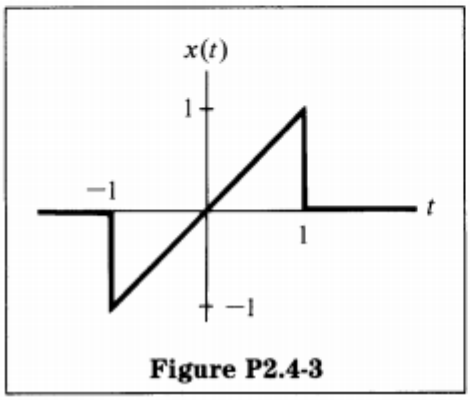
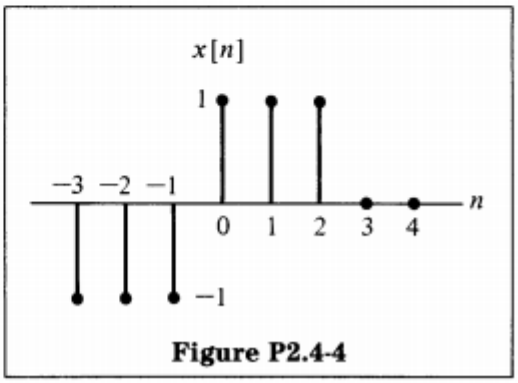
Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Energy signals power signals
Lecture 3	Continuous and discrete time signals
Lecture 4	Continuous amplitude signals
Lecture 5	and discrete amplitude signals
Lecture 6	System properties: linearity: additivity and homogeneity
Lecture 7	shift-invariance, causality
Lecture 8	stability, realizability.
Lecture 9	Linear shift-invariant (LSI) systems
Lecture 10	impulse response
Lecture 11	Step response
Lecture 12	Convolution.
Lecture 13	Input output behavior with aperiodic convergent inputs
Lecture 14	Characterization of causality and stability of linear shift-invariant systems.
Lecture 15	System representation through differential equations and difference equations.
Lecture 16	Characterization of causality and stability of linear shift-invariant systems.
Lecture 17	System representation through differential equations and difference equations.
Lecture 18	Periodic and semi-periodic inputs to an LSI system
Lecture 19	The notion of a frequency response.
Lecture 20	Its relation to the impulse response
Lecture 21	Fourier series representation
Lecture 22	Fourier Transform
Lecture 23	Convolution/multiplication and their effect in the frequency domain
Lecture 24	Magnitude and phase response
Lecture 25	Fourier domain duality.
Lecture 26	The Discrete-Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT).
Lecture 27	Parseval's Theorem. The idea of signal space and orthogonal bases
Lecture 28	The Laplace Transform
Lecture 29	Notion of eigen functions of LSI systems

Lecture 30	A basis of eigen functions, region of convergence
Lecture 31	Poles and zeros of system, Laplace domain analysis,
Lecture 32	Solution to differential equations and system behavior.
Lecture 33	The z-Transform for discrete time signals and systems- eigen functions,
Lecture 34	Region of convergence, z-domain analysis.
Lecture 35	State-space analysis and multi-input, multi-output representation.
Lecture 36	The state-transition matrix and its role.
Lecture 37	The Sampling Theorem and its implications- Spectra of sampled signals.
Lecture 38	Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on
Lecture 39	Aliasing and its effects.
Lecture 40	Relation between continuous and discrete time systems.

Content delivery method:

1. Chalk and Duster
2. PPT
3. Animation
4. Hand-outs

Assignments:

Assignment	For each of the following signals, determine whether it is even, odd, or neither. **(a)**  **Figure P2.4-1** **(b)**  **Figure P2.4-2** **(c)**  **Figure P2.4-3** **(d)**  **Figure P2.4-4**

Evaluate the following sums:

(a) $\sum_{n=0}^{5} 2\left(\frac{3}{a}\right)^n$

(b) $\sum_{n=2}^{6} b^n$

(c) $\sum_{n=0}^{\infty} \left(\frac{2}{3}\right)^{2n}$

Hint: Convert each sum to the form

$$C\sum_{n=0}^{N-1} \alpha^n = S_N \quad \text{or} \quad C\sum_{n=0}^{\infty} \alpha^n = S_\infty$$

and use the formulas

$$S_N = C\left(\frac{1-\alpha^N}{1-\alpha}\right), \quad S_\infty = \frac{C}{1-\alpha} \quad \text{for } |\alpha| < 1$$

The first-order difference equation $y[n] - ay[n-1] = x[n]$, $0 < a < 1$, describes a particular discrete-time system initially at rest.

(a) Verify that the impulse response $h[n]$ for this system is $h[n] = a^n u[n]$.

(b) Is the system

(i) memoryless?

(ii) causal?

(iii) stable?

Clearly state your reasoning.

(c) Is this system stable if $|a| > 1$?

Assignment

Consider a discrete-time system with impulse response

$$h[n] = (\tfrac{1}{2})^n u[n]$$

Determine the response to each of the following inputs:

(a) $x[n] = (-1)^n = e^{j\pi n}$ for all n

(b) $x[n] = e^{j(\pi n/4)}$ for all n

(c) $x[n] = \cos\left(\frac{\pi n}{4} + \frac{\pi}{8}\right)$ for all n

---

Consider two specific periodic sequences $\tilde{x}[n]$ and $\tilde{y}[n]$. $\tilde{x}[n]$ has period N and $\tilde{y}[n]$ has period M. The sequence $\tilde{w}[n]$ is defined as $\tilde{w}[n] = \tilde{x}[n] + \tilde{y}[n]$.

(a) Show that $\tilde{w}[n]$ is periodic with period MN.

(b) Since $\tilde{x}[n]$ has period N, its discrete Fourier series coefficients a_k also have period N. Similarly, since $\tilde{y}[n]$ has period M, its discrete Fourier series coefficients b_k also have period M. The discrete Fourier series coefficients of $\tilde{w}[n]$, c_k, have period MN. Determine c_k in terms of a_k and b_k.

The sequence $x[n] = (-1)^n$ is obtained by sampling the continuous-time sinusoidal signal $x(t) = \cos \omega_0 t$ at 1-ms intervals, i.e.,

$$\cos(\omega_0 nT) = (-1)^n, \qquad T = 10^{-3}\ \text{s}$$

Determine three *distinct* possible values of ω_0.

3EC4-06: Network Theory

4 Credits **Max. Marks: 200 (IA:40, ETE:160)**

3L:1T:0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality.	7
2	Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC. circuits.	7
3	Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.	8
4	Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions..	8
5	Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two four port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.	10
	Total	40

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-06	Network Theory	CO 1	Apply the basic circuital law and simplify the network using network theorems
		CO 2	Appreciate the frequency domain techniques in different applications.
		CO 3	Apply Laplace Transform for steady state and transient analysis
		CO 4	Evaluate transient response and two-port network parameters
		CO 5	Analyze the series resonant and parallel resonant circuit and design filters

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-06 Network Theory	CO 1	3	2		3	2							
	CO 2	3	3	1	2	2							1
	CO 3	3	2	2		2							1
	CO 4	2	3	2	2	1							
	CO 5	2	3	3	2	1							

3: Strongly 2: Moderate 1: Weak

Lecture Plan:

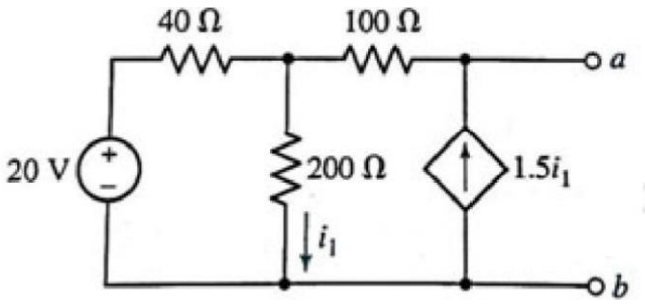
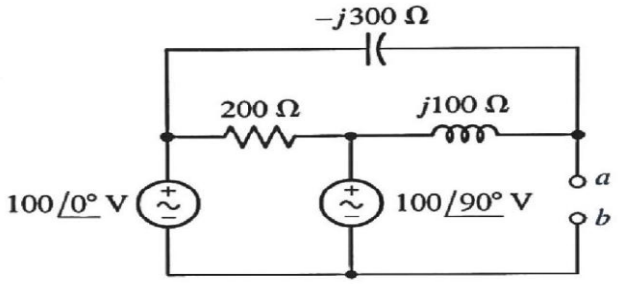
Lecture No.	Content to be taught
Lecture 1	Overview of Network Theory and its significance
Lecture 2	Node and Mesh Analysis
Lecture 3	matrix approach of network containing voltage and current sources and reactances
Lecture 4	source transformation and duality
Lecture 5	Network theorems: Superposition and reciprocity
Lecture 6	Thevenin's and Norton's theorem
Lecture 7	Maximum power Transfer theorem
Lecture 8	compensation and Tallegen's theorem as applied to AC. Circuits
Lecture 9	Trigonometric and exponential Fourier series
Lecture 10	Fourier series: Discrete spectra and symmetry of waveform
Lecture 11	Steady state response of a network to non-sinusoidal periodic inputs
Lecture 12	power factor and effective values
Lecture 13	Fourier transform and continuous spectra
Lecture 14	three phase unbalanced circuit and power calculation
Lecture 15	three phase unbalanced circuit and power calculation
Lecture 16	Laplace transforms
Lecture 17	Laplace transforms
Lecture 18	Laplace transforms properties: Partial fractions
Lecture 19	singularity functions and waveform synthesis

Lecture 20	analysis of RC networks
Lecture 21	analysis of RL networks
Lecture 22	analysis of RLC networks
Lecture 23	Analysis of networks with and without initial conditions
Lecture 24	Analysis of networks with and without initial conditions
Lecture 25	Analysis of networks with and without initial conditions with lapalace transforms evaluation
Lecture 26	Analysis of networks with and without initial conditions with lapalace transforms evaluation of initial condition
Lecture 27	Transient behavior
Lecture 28	concept of complex frequency
Lecture 29	Driving points and transfer functions poles and zeros of immittance function
Lecture 30	Driving points and transfer functions poles and zeros of immittance function: their properties
Lecture 31	sinusoidal response from pole-zero locations
Lecture 32	sinusoidal response from pole-zero locations
Lecture 33	convolution theorem
Lecture 34	sinusoidal response from pole-zero locations
Lecture 35	Two four port network and interconnections
Lecture 36	Two four port network and interconnections
Lecture 37	Behaviors of series and parallel resonant circuits
Lecture 38	Introduction to band pass and low pass
Lecture 39	Introduction to high pass and reject filters
Lecture 40	Spill over class

Content delivery method:

1. Chalk and Duster
2. PPT
3. Hand-outs

Sample assignments:

Assignment 1	**Q1.**	Elaborate the significance of source transformation with relevant example
	Q2.	State and prove time differentiation theorem in Laplace Transform
	Q3.	Find the Thevenin equivalent of the network shown in figure. What power would be delivered to a load of 100 ohms at *a* and *b*? 
Assignment 2	**Q4.**	Calculate Thevenin equivalent circuit with respect to terminals *a* and *b* 
	Q5.	Derive transient current and voltage responses of sinusoidal driven RL and RC circuits.
	Q6.	Specify the restrictions on pole and zero locations for transfer functions and driving-point functions.

3EC4-07: Electronic Devices

4 Credits **Max. Marks: 200 (IA:40, ETE:160)**

3L:1T:0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction to Semiconductor Physics: Introduction, Energy band gap structures of semiconductors, Classifications of semiconductors, Degenerate and non-degenerate semiconductors, Direct and indirect band gap semiconductors, Electronic properties of Silicon, Germanium, Compound Semiconductor, Gallium Arsenide, Gallium phosphide & Silicon carbide, Variation of semiconductor conductivity, resistance and bandgap with temperature and doping. Thermistors, Sensitors.	6
2	Review of Quantum Mechanics, Electrons in periodic Lattices, E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors.	6
3	Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode.	8
4	Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, MOSFET, I-V characteristics, and small signal models of MOS transistor, LED, photodiode and solar cell.	11
5	Integrated circuit fabrication process: oxidation, diffusion, ion implantation, Photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.	9
	Total	**40**

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-07	Electronic Devices	CO 1	Understanding the semiconductor physics of the intrinsic, P and N materials.
		CO 2	Understanding the characteristics of current flow in a bipolar junction transistor and MOSFET.
		CO 3	Understand and utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems.
		CO 4	Analyze the characteristics of different electronic devices such as Amplifiers, LEDs, Solar cells, etc.
		CO 5	Theoretical as well as experimental understanding of Integrated circuit fabrication.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-07 Electronic Devices	CO 1	3	1		2	1	1						
	CO 2	3	2	1			2						
	CO 3	2	1		2		1	2					
	CO 4	3	1	1				2					
	CO 5	3	1	1	1	1							2

3: Strongly **2: Moderate** **1: Weak**

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Lecture Plan:

Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Introduction to Semiconductor Physics
Lecture 3	Introduction to Semiconductor Physics
Lecture 4	Introduction to Semiconductor Physics
Lecture 5	Review of Quantum Mechanics
Lecture 6	Electrons in periodic Lattices
Lecture 7	E-k diagrams
Lecture 8	Energy bands in intrinsic and extrinsic silicon
Lecture 9	Carrier transport: diffusion current, drift current, mobility and resistivity
Lecture 10	Sheet resistance and design of resistors
Lecture 11	Generation and recombination of carriers
Lecture 12	Poisson and continuity equation
Lecture 13	P-N junction characteristics and their I-V characteristics
Lecture 14	P-N junction characteristics and their I-V characteristics
Lecture 15	P-N junction small signal switching models
Lecture 16	P-N junction small signal switching models
Lecture 17	Avalanche breakdown
Lecture 18	Zener diode and Schottky diode
Lecture 19	Basics of Bipolar Junction Transistor
Lecture 20	I-V characteristics of BJT
Lecture 21	Ebers-Moll Model
Lecture 22	MOS capacitor
Lecture 23	MOS capacitor

Lecture 24	C-V characteristics
Lecture 25	Basics of MOSFET
Lecture 26	Basics of MOSFET
Lecture 27	I-V characteristics of MOSFET
Lecture 28	Small signal models of MOS transistor
Lecture 29	Small signal models of MOS transistor
Lecture 30	Light Emitting Diode
Lecture 31	Photodiode and solar cell
Lecture 32	Basics of Integrated Circuits
Lecture 33	Advancement in Integrated Circuits
Lecture 34	Oxidation, diffusion and ion implantation
Lecture 35	Photolithography and etching
Lecture 36	Chemical vapor deposition
Lecture 37	Sputtering
Lecture 38	Twin-tub CMOS process
Lecture 39	Spill over class
Lecture 40	Spill over class

Content delivery method:

1. Chalk and Duster
2. PPT
3. Hand-outs

Sample assignments:

Assignment 1	**Q1.**	Investigates the input/output characteristics of various diodes?
	Q2.	Investigate the applications of various diodes?
	Q3.	A p-type sample of silicon has a resistivity of 5 Ω-cm. In this sample, the hole mobility, μ_h, is 600 cm^2/V-s and the electron mobility, μ_e, is 1600 cm^2/V-s. Ohmic contacts are formed on the ends of the sample and a uniform electric field is imposedwhich results in a drift current density in the sample is 2 x 10^3 A/cm^2. [1]. What are the hole and electron concentrations in this sample? [2]. What are the hole and electron drift velocities under these conditions? [3]. What is the magnitude of the electric field?
Assignment 2	**Q1.**	Discuss the applications of Ebers-Moll Model.
	Q2.	Discuss different types of fabrication techniques.
	Q3.	Discuss various characteristics of CMOS transistor.

3EC4-21: Electronics Devices Lab

1 Credit **Max. Marks: 50 (IA:30, ETE:20)**

0L:0T:2P

List of Experiments

Sr. No.	Name of Experiment
1.	Study the following devices: (a) Analog& digital multimeters (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations) (d) Study of analog and digital CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
2.	Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances.
3.	Plot the output waveform of half wave rectifier and effect of filters on waveform. Also calculate its ripple factor.
4.	Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple factor.
5.	Plot and verify output waveforms of different clipper and clamper.
6.	Plot V-I characteristic of Zener diode
7.	Study of Zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator
8.	Plot input-output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters.
9.	Study of different biasing circuits of BJT amplifier and calculate its Q-point.
10.	Plot frequency response of two stage RC coupled amplifier & calculate its bandwidth .
11.	Plot input-output characteristics of field effect transistor and measure I_{dss} and V_p.
12.	Plot frequency response curve for FET amplifier and calculate its gain bandwidth product.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-21	Electronic Devices Lab	CO 1	Understand the characteristics of different Electronic Devices.
		CO 2	Verify the rectifier circuits using diodes and implement them using hardware.
		CO 3	Design various amplifiers like CE, CC, common source amplifiers and implement them using hardware and also observe their frequency responses
		CO 4	Understand the construction, operation and characteristics of JFET and MOSFET, which can be used in the design of amplifiers.
		CO 5	Understand the need and requirements to obtain frequency response from a transistor so that Design of RF amplifiers and other high frequency amplifiers is feasible

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-21 Electronic Devices Lab	CO 1	3	2	3	2	1							1
	CO 2	2	3	1	3	3							2
	CO 3	2	1	2	3	3							
	CO 4	3	2	3	2	2							1
	CO 5	3	2	1	2	2							

3: Strongly **2: Moderate** **1: Weak**

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3EC4-22: Digital System Design Lab

1 Credit **Max. Marks: 50 (IA:30, ETE:20)**

0L:0T:2P

List of Experiments

S.No.	Name of Experiment
Part A: Combinational Circuits	
1.	To verify the truth tables of logic gates: AND, OR, NOR, NAND, NOR, Ex-OR and Ex-NOR
2.	To verify the truth table of OR, AND, NOR, Ex-OR, Ex-NOR logic gates realized using NAND & NOR gates.
3.	To realize an SOP and POS expression.
4.	To realize Half adder/ Subtractor& Full Adder/ Subtractor using NAND & NOR gates and to verify their truth tables
5.	To realize a 4-bit ripple adder/ Subtractor using basic Half adder/ Subtractor& basic Full Adder/ Subtractor.
6.	To design 4-to-1 multiplexer using basic gates and verify the truth table. Also verify the truth table of 8-to-1 multiplexer using IC
7.	To design 1-to-4 demultiplexer using basic gates and verify the truth table. Also to construct 1-to-8 demultiplexer using blocks of 1-to-4 demultiplexer
8.	To design 2x4 decoder using basic gates and verify the truth table. Also verify the truth table of 3x8 decoder using IC
9.	Design & Realize a combinational circuit that will accept a 2421 BCD code and drive a TIL -312 seven-segment display
Part B: Sequential Circuits	
10.	Using basic logic gates, realize the R-S, J-K and D-flip flops with and without clock signal and verify their truth table.
11.	Construct a divide by 2, 4 & 8 asynchronous counter. Construct a 4-bit binary counter and ring counter for a particular output pattern using D flip flop.
12.	Design and construct unidirectional shift register and verify the
13.	Design and construct BCD ripple counter and verify the function.
14.	Design and construct a 4 Bit Ring counter and verify the function
15.	Perform input/output operations on parallel in/Parallel out and Serial in/Serial out registers using clock. Also exercise loading only one of multiple values into the register using multiplexer.

Note: Minimum 6 experiments to be conducted from **Part-A**& 4 experiments to be conducted from **Part-B.**

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-22	Digital System Design Lab	CO 1	
		CO 2	To minimize the complexity of digital logic circuits.
		CO 3	To design and analyse combinational logic circuits.
		CO 4	To design and analyse sequential logic circuits.
		CO 5	Able to implement applications of combinational & sequential logic circuits.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-22 Digital System Design Lab	CO 1	3	3	1									1
	CO 2	3	3	2	1	1							1
	CO 3	3	3	3	2	3	1						2
	CO 4	3	3	3	2	3	1						2
	CO 5	3	3	3	3	3	3						3

3: Strongly 2: Moderate 1: Weak

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3EC4-23: Signal Processing Lab

1 Credit **Max. Marks: 50 (IA:30, ETE:20)**

0L:0T:2P

List of Experiments

Sr. No.	Name of Experiment (Simulate using MATLAB environment)
1.	Generation of continuous and discrete elementary signals (periodic and non periodic) using mathematical expression.
2.	Generation of Continuous and Discrete Unit Step Signal.
3.	Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4.	Continuous and discrete time Convolution (using basic definition).
5.	Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6.	To generate uniform random numbers between (0, 1).
7.	To generate a random binary wave.
8.	To generate and verify random sequences with arbitrary distributions, means and variances for following: (a) Rayleigh distribution (b) Normal distributions: N(0,1). (c) Gaussion distributions: N (m, x)
9.	To plot the probability density functions. Find mean and variance for the above distributions

Course Outcome:

Course Code	Course Name	Course Outcome	Details
3EC4-23	Signal Processing Lab	CO 1	Able to generate different Continuous and Discrete time signals.
		CO 2	Understand the basics of signals and different operations on signals.
		CO 3	Develop simple algorithms for signal processing and test them using MATLAB
		CO 4	Able to generate the random signals having different distributions, mean and variance.
		CO 5	Design and conduct experiments, interpret and analyse data and report results.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
3EC4-23 Signal Processing Lab	CO 1	2		1		2							
	CO 2	3		1									
	CO 3	1	2	3	1	3							
	CO 4	2	1	1		2							
	CO 5	1	1	2	2	2							

3: Strongly **2: Moderate** **1: Weak**

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3EC3-24: Computer Programming Lab-I

1 Credit **Max. Marks: 50 (IA:30, ETE:20)**
0L:0T:2P

1.	Write a simple C program on a 32 bit compiler to understand the concept of array storage, size of a word. The program shall be written illustrating the concept of row major and column major storage. Find the address of element and verify it with the theoretical value. Program may be written for arrays upto 4-dimensions.
2.	Simulate a stack, queue, circular queue and dequeue using a one dimensional array as storage element. The program should implement the basic addition, deletion and traversal operations.
3.	Represent a 2-variable polynomial using array. Use this representation to implement addition of polynomials.
4.	Represent a sparse matrix using array. Implement addition and transposition operations using the representation.
5.	Implement singly, doubly and circularly connected linked lists illustrating operations like addition at different locations, deletion from specified locations and traversal.
6.	Repeat exercises 2, 3 & 4 with linked structures.
7.	Implementation of binary tree with operations like addition, deletion, traversal.
8.	Depth first and breadth first traversal of graphs represented using adjacency matrix and list.
9.	Implementation of binary search in arrays and on linked Binary Search Tree.
10.	Implementation of insertion, quick, heap, topological and bubble sorting algorithms.

4EC2-01: Advance Engineering Mathematics-II

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Complex Variable – Differentiation:** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	7
3	**Complex Variable - Integration:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).	8
4	**Applications of complex integration by residues:** Evaluation of definite integral involving sine and cosine. Evaluation of certain improper integrals.	4
5	**Special Functions:** Legendre's function, Rodrigues formula, generating function, Simple recurrence relations, orthogonal property. Bessel's functions of first and second kind, generating function, simple recurrence relations, orthogonal property.	10
6	**Linear Algebra:** Vector Spaces, subspaces, Linear independence, basis and dimension, Inner product spaces, Orthogonality, Gram Schmidt orthogonalization, characteristic polynomial, minimal polynomial, positive definite matrices and canonical forms, QR decomposition.	10
	Total	40

4EC1-03/3EC1-03: Managerial Economics And Financial Accounting

2 Credit **Max. Marks: 100 (IA:20, ETE:80)**
2L:0T:0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Basic economic concepts:** Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	3
3	**Demand and Supply analysis:** Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
4	**Production and Cost analysis:** Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
5	**Market structure and pricing theory:** Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
6	**Financial statement analysis:** Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
	Total	26

4EC1-02/3EC1-02: Technical Communication

2 Credit **Max. Marks: 100 (IA:20, ETE:80)**
2L:0T:0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**Introduction to Technical Communication-** Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	3
3	**Comprehension of Technical Materials/Texts and Information Design & development-** Reading of technical texts, Readingand comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
4	**Technical Writing, Grammar and Editing-** Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
5	**Advanced Technical Writing**- Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
	Total	26

4EC4-04: Analog Circuits

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Diode Circuits, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, low frequency analysis of multistage amplifiers.	8
3	High frequency transistor models, frequency response of single stage and multistage amplifiers, cascode amplifier. Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues. Feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.	8
4	Oscillators: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators. Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load. Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR. OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages, compensation.	8
5	OP-AMP applications: review of 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, design guidelines.	8
6	Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog to digital converters (ADC): Single slope, dual slope, successive approximation, flash etc. Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.	7
	Total	40

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Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-04	Analog Circuits	CO 1	Understand the characteristics of diodes and transistors
		CO 2	Design and analyze various rectifier and amplifier circuits
		CO 3	Design sinusoidal and non-sinusoidal oscillators
		CO 4	Understand the functioning of OP-AMP and design OP-AMP based circuits
		CO 5	Understanding the designing of ADCs and DACs

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-04 Analog Circuits	CO 1	3		1	1	2							
	CO 2	1	1	2		1							
	CO 3	3	1		1								
	CO 4	2				2							
	CO 5	2	3		2								

3: Strongly **2: Moderate** **1: Weak**

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Lecture Plan:

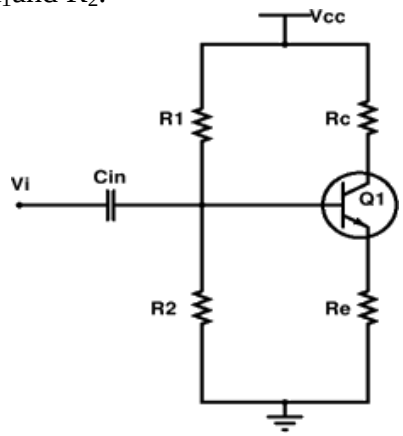
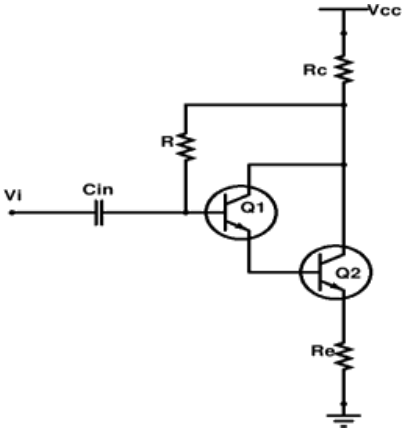
Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Diode Circuits and Amplifier models
Lecture 3	Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier
Lecture 4	Biasing schemes for BJT and FET amplifiers
Lecture 5	Bias stability in various configurations such as CE/CS, CB/CG, CC/CD
Lecture 6	Small signal analysis of BJT and FET
Lecture 7	low frequency transistor models
Lecture 8	Estimation of voltage gain, input resistance, output resistance etc.
Lecture 9	Design procedure for particular specifications, low frequency analysis of multistage amplifiers.
Lecture 10	High frequency transistor models
Lecture 11	frequency response of single stage and multistage amplifiers
Lecture 12	Cascode Amplifier
Lecture 13	Various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues
Lecture 14	Feedback topologies: Voltage series, current series, voltage shunt, current shunt
Lecture 15	Effect of feedback on gain, bandwidth etc.,
Lecture 16	Calculation with practical circuits
Lecture 17	Concept of stability, gain margin and phase margin.
Lecture 18	Basics of oscillator
Lecture 19	Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.)

Lecture 20	LC oscillators (Hartley, Colpitt, Clapp etc.)
Lecture 21	Non-sinusoidal oscillators. Current mirror: Basic topology and its variants,
Lecture 22	V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.
Lecture 23	Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.
Lecture 24	OP-AMP design: design of differential amplifier for a given specification
Lecture 25	Design of gain stages and output stages, compensation
Lecture 26	OP-AMP applications: review of inverting and non-inverting amplifiers
Lecture 27	Integrator and differentiator, summing amplifier
Lecture 28	Precision rectifier, Schmitt trigger and its applications
Lecture 29	Active filters: Low pass, high pass
Lecture 30	Band pass and band stop Filters
Lecture 31	Filter Design guidelines
Lecture 32	Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc
Lecture 33	Analog to digital converters (ADC): Single slope, dual slope
Lecture 34	successive approximation, flash TYPE ADC
Lecture 35	Switched capacitor circuits: Basic concept
Lecture 36	Switched capacitor circuits: practical configurations
Lecture 37	Switched capacitor circuits: applications
Lecture 38	Spill over classes
Lecture 39	Spill over classes
Lecture 40	Spill over classes

Content delivery method:

1. Chalk and Duster
2. PPT
3. Hand-outs

Sample assignments:

Assignment 1	**Q1.** Assume that a silicon transistor with β =50, $V_{BEactive}$=0.7 V, V_{CC} =15V and R_C=10K is used in the Fig.1.It is desired to establish a Q-point at V_{CE}=7.5 V and I_C=5mA and stability factor S≤5.Find Re,$R_1$and R_2. 
	Q2. In the Darlington stage shown in Fig.2 , V_{CC}=15V , β_1=50, β_2=75,V_{BE}=0.7,R_C=750 Ω and R_E=100 Ω. If at the quiescent point V_{CE2}=6V determine the value of R. 
	Q3. For the amplifier shown in Fig.3 using a transistor whose parameters are h_{ie}=1100,h_{re}=2.5×10^{-4},h_{fe}=50,h_{oe}=24μA/V.Find A_I, A_V, A_{VS} and R_i.

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	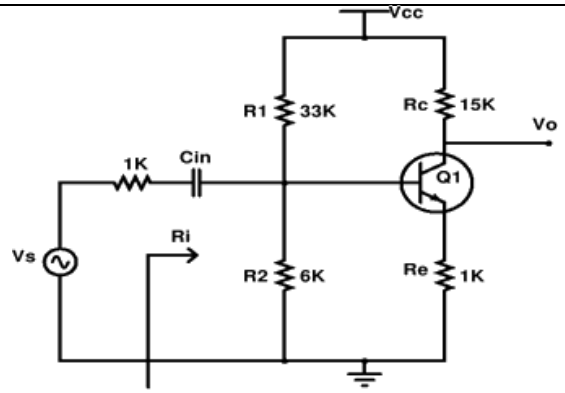
Assignment 2	**Q1.** Discuss the applications of operational amplifier.
	Q2. Discuss different types of filters.
	Q3. Discuss Dual counter type DAC and its applications

4EC4-05: Microcontrollers

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Overview of microcomputer systems and their building blocks, memory interfacing, concepts of interrupts and Direct Memory Access, instruction sets of microprocessors (with examples of 8085 and 8086);	10
3	Interfacing with peripherals - timer, serial I/O, parallel I/O, A/D and D/A converters; Arithmetic Coprocessors; System level interfacing design;	8
4	Concepts of virtual memory, Cache memory, Advanced coprocessor Architectures- 286, 486, Pentium; Microcontrollers: 8051 systems,	10
5	Introduction to RISC processors; ARM microcontrollers interface designs.	11
	Total	40

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-05	Microcontrollers	CO 1	Develop assembly language programming skills.
		CO 2	Able to build interfacing of peripherals like, I/O, A/D, D/A, timer etc.
		CO 3	Develop systems using different microcontrollers.
		CO 4	Explain the concept of memory organization.
		CO 5	Understand RSIC processors and design ARM microcontroller based systems.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC04-05Microcontrollers	CO 1			3	1								
	CO 2			3		1							
	CO 3	1	2	3									
	CO 4	3	2	1									
	CO 5			3	2	1							

3: Strongly 2: Moderate 1: Weak

Lecture Plan:

Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Overview of microcomputer systems and their building blocks
Lecture 3	Overview of microcomputer systems and their building blocks
Lecture 4	Memory interfacing
Lecture 5	Memory interfacing
Lecture 6	Concepts of interrupts

Lecture 7	Direct Memory Access
Lecture 8	Direct Memory Access
Lecture 9	Instruction sets of microprocessors (with examples of 8085 and 8086)
Lecture 10	Instruction sets of microprocessors (with examples of 8085 and 8086)
Lecture 11	Instruction sets of microprocessors (with examples of 8085 and 8086)
Lecture 12	Instruction sets of microprocessors (with examples of 8085 and 8086)
Lecture 13	Interfacing with peripherals
Lecture 14	Timer
Lecture 15	Serial I/O
Lecture 16	Parallel I/O
Lecture 17	A/D and D/A converters;
Lecture 18	A/D and D/A converters
Lecture 19	Arithmetic Coprocessors
Lecture 20	System level interfacing design
Lecture 21	Concepts of virtual memory, Cache memory
Lecture 22	Concepts of virtual memory, Cache memory
Lecture 23	Advanced coprocessor Architectures- 286, 486, Pentium
Lecture 24	Advanced coprocessor Architectures- 286, 486, Pentium
Lecture 25	Advanced coprocessor Architectures- 286, 486, Pentium
Lecture 26	Microcontrollers: 8051 systems,
Lecture 27	Microcontrollers: 8051 systems,
Lecture 28	Microcontrollers: 8051 systems,
Lecture 29	Microcontrollers: 8051 systems,
Lecture 30	Microcontrollers: 8051 systems,
Lecture 31	Introduction to RISC processors
Lecture 32	Introduction to RISC processors
Lecture 33	Introduction to RISC processors
Lecture 34	ARM microcontrollers interface designs
Lecture 35	ARM microcontrollers interface designs
Lecture 36	ARM microcontrollers interface designs
Lecture 37	ARM microcontrollers interface designs
Lecture 38	ARM microcontrollers interface designs
Lecture 39	Spill Over Classes
Lecture 40	Spill Over Classes

Content delivery method:

1. Chalk and Duster
2. PPT
3. Hand-outs

Assignments:

Assignment 1	**Q1.** Compare between microprocessor & microcontroller based on no. of instructions used, registers, memory and applications.
	Q2. Interface external program memory with 8051 & explain how the data is transfer.
	Q3. List the I/O ports of microcontroller 8051. Explain their alternative function?
Assignment 2	**Q1.** Explain RISC and CISC?
	Q2. Without using MUL instruction, perform multiplication operation on any two operands, with both of them being: a. Positive numbers b. One positive and other negative number c. Both negative numbers Verify the values computed.
	Q3. Can you brief up the evolution of ARM architecture?

4EC3-06: Electronics Measurement & Instrumentation

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	**THEORY OF ERRORS** - Accuracy & precision, Repeatability, Limits of errors, Systematic & random errors, Modeling of errors, Probable error & standard deviation, Gaussian error analysis, Combination of errors.	8
3	**ELECTRONIC INSTRUMENTS** - Electronic Voltmeter, Electronic Multimeters, Digital Voltmeter, and Component Measuring Instruments: Q meter, Vector Impedance meter, RF Power & Voltage Measurements, Introduction to shielding & grounding.	8
4	**OSCILLOSCOPES** – CRT Construction, Basic CRO circuits, CRO Probes, Techniques of Measurement of frequency, Phase Angle and Time Delay, Multibeam, multi trace, storage & sampling Oscilloscopes.	7
5	**SIGNAL GENERATION AND SIGNAL ANALYSIS** - Sine wave generators, Frequency synthesized signal generators, Sweep frequency generators. Signal Analysis - Measurement Technique, Wave Analyzers, and Frequency - selective wave analyser, Heterodyne wave analyser, Harmonic distortion analyser, and Spectrum analyser.	8
6	**TRANSDUCERS** - Classification, Selection Criteria, Characteristics, Construction, Working Principles and Application of following Transducers:- RTD, Thermocouples, Thermistors, LVDT, Strain Gauges, Bourdon Tubes, Seismic Accelerometers, Tachogenerators, Load Cell, Piezoelectric Transducers, Ultrasonic Flow Meters.	8
	Total	40

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC3-06	ELECTRONIC MEASUREMENT & INSTRUMENTATION	CO 1	**Describe** the use of various electrical/electronic instruments, their block diagram, applications, dnd principles of operation, standards eorrs and units of measurements.
		CO 2	**Develop** basic skills in the design of electronic equipments
		CO 3	**Analyse** different electrical/electronic parameters using state of equipments of measuring instruments which is require to all types of industries.
		CO 4	**Solve :**Identify electronics/ electrical instruments, understanding associated with the instruments
		CO 5	**Explain** use of transducers in different types of field applications

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC3-06 ELECTRONIC MEASUREMENT & INSTRUMENTATION	CO 1	3	2	1									
	CO 2	2	2	2	3								
	CO 3	2	3										
	CO 4	2	1	1				2					
	CO 5	3	1										2

3: Strongly **2: Moderate** **1: Weak**

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Lecture Plan:

Lecture No.	Content to be taught
Lecture 1	Zero Lecture
Lecture 2	Theory of errors
Lecture 3	Accuracy & precision, Repeatability
Lecture 4	Limits of Time-Hours errors
Lecture 5	Systematic & random errors
Lecture 6	Modeling of errors
Lecture 7	Probable error
Lecture 8	standard deviation
Lecture 9	Gaussian error analysis
Lecture 10	Combination of errors
Lecture 11	Electronic instruments - Electronic Voltmeter
Lecture 12	Electronic Multimeters
Lecture 13	Digital Voltmeter
Lecture 14	Component Measuring Instruments: Q meter
Lecture 15	Vector Impedance meter
Lecture 16	RF Power & Voltage Measurements
Lecture 17	Introduction to shielding & grounding
Lecture 18	Oscilloscopes - CRT Construction
Lecture 19	Basic CRO circuits, CRO Probes
Lecture 20	Techniques of Measurement of frequency, Phase Angle and Time Delay
Lecture 21	Multibeam, multi trace, storage & sampling Oscilloscopes
Lecture 22	Multibeam, multi trace, storage & sampling Oscilloscopes
Lecture 23	Signal generation and signal analysis - Sine wave generators,
Lecture 24	Frequency synthesized signal generators
Lecture 25	Sweep frequency generators
Lecture 26	Signal Analysis - Measurement Technique
Lecture 27	Wave Analyzers, and Frequency - selective wave analyser
Lecture 28	Heterodyne wave analyser
Lecture 29	Harmonic distortion analyser
Lecture 30	Spectrum analyser
Lecture 31	Transducers – Classification
Lecture 32	Selection Criteria Characteristics
Lecture 33	Construction, Working Principles and Application of following Transducers:- RTD

Lecture 34	Thermocouples
Lecture 35	Thermistors
Lecture 36	LVDT Strain Gauges, Bourdon Tubes
Lecture 37	Seismic Accelerometers
Lecture 38	Tachogenerators, Load Cell,
Lecture 39	Piezoelectric Transducers
Lecture 40	Ultrasonic Flow Meters

Content delivery method:

1. Chalk and Duster
2. PPT
3. Hand-outs

Sample assignments:

Assignment 1	**Q1.**	Write the principal of an AC Bridge used for the measurement of Unknown capacitor
	Q2.	Distinguish Between Accuracy and Precision?
	Q3.	Explain flow measurement with a suitable example.
Assignment 2	**Q1.**	What are primary sensing elements and transducers?
	Q2.	A Wheatstone Bridge requires to change of 7Ω in unknown arm of bridge to change in deflection of 14 mm. of galvanometer deter mine the sensitivity and deflection factor.
	Q3.	Explain the terms static error, static correction, relative error and percentage relative error.

4EC4-07: Analog and Digital Communication

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Introduction:** Objective, scope and outcome of the course.	1
2	Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.	8
3	Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation.	7
4	Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.	8
5	Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.	8
6	Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.	8
	Total	40

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-07	Analog and Digital Communication	CO 1	Analyze and compare different analog modulation schemes for their efficiency and bandwidth
		CO 2	Analyze the behavior of a communication system in presence of noise
		CO 3	Investigate pulsed modulation system and analyze their system performance
		CO 4	Analyze different digital modulation schemes and can compute the bit error performance
		CO 5	Design a communication system comprised of both analog and digital modulation techniques

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-07 Analog & Digital Communication	CO 1	3	3		3		1				1		
	CO 2	3	2		3		1						
	CO 3	3	2		3		2						
	CO 4	3	3		3		2				1		
	CO 5	3	2	3	3		3			2	2		

3: Strongly 2: Moderate 1: Weak

Content delivery method:

1. Chalk and Duster
2. PPT

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Lecture Plan:

Lecture No.	Content to be taught
Lecture 1	Introduction to the COURSE
Lecture 2	Review of signals and systems, Frequency domain representation of signals
Lecture 3	Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations
Lecture 4	Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations
Lecture 5	Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations
Lecture 6	Angle Modulation, Representation of FM and PM signals
Lecture 7	Angle Modulation, Representation of FM and PM signals
Lecture 8	Spectral characteristics of angle modulated signals.
Lecture 9	Review of probability and random process
Lecture 10	Review of probability and random process
Lecture 11	Noise in amplitude modulation systems
Lecture 12	Noise in amplitude modulation systems
Lecture 13	Noise in Frequency modulation systems
Lecture 14	Pre-emphasis and Deemphasis
Lecture 15	Threshold effect in angle modulation
Lecture 16	Pulse modulation. Sampling
Lecture 17	Pulse Amplitude and Pulse code modulation (PCM)
Lecture 18	Pulse Amplitude and Pulse code modulation (PCM)
Lecture 19	Differential pulse code modulation
Lecture 20	Delta modulation
Lecture 21	Noise considerations in PCM

Lecture 22	Time Division multiplexing, Digital Multiplexers
Lecture 23	Elements of Detection Theory
Lecture 24	Optimum detection of signals in noise
Lecture 25	Coherent communication with waveforms- Probability of Error evaluations
Lecture 26	Coherent communication with waveforms- Probability of Error evaluations
Lecture 27	Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion
Lecture 28	Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion
Lecture 29	Pass band Digital Modulation schemes
Lecture 30	Phase Shift Keying
Lecture 31	Frequency Shift Keying
Lecture 32	Quadrature Amplitude Modulation
Lecture 33	Continuous Phase Modulation and Minimum Shift Keying.
Lecture 34	Digital Modulation tradeoffs
Lecture 35	Optimum demodulation of digital signals over band-limited channels
Lecture 36	Optimum demodulation of digital signals over band-limited channels
Lecture 37	Maximum likelihood sequence detection (Viterbi receiver)
Lecture 38	Equalization Techniques
Lecture 39	Synchronization and Carrier Recovery for Digital modulation
Lecture 40	Synchronization and Carrier Recovery for Digital modulation

Assignments:

Assignment 1	**Q1.** Design Modulator and Demodulator of SSB-SC Modulation based on its mathematical expression.
	Q2. Derive the figure of merit in a) FM Receiver b) PM Receiver
	Q3. A Carrier signal c(t) = 20 cos ($2\pi 10^6$t) is modulated by a message signal having three frequencies 5 KHz, 10 KHz & 20 KHz. The corresponding modulation indexes are 0.4, 0.5 & 0.6. Sketch the spectrum. Calculate bandwidth, power and efficiency.
Assignment 2	**Q1.** Derive the expression for probability of error in ASK, FSK and PSK systems and compare them.
	Q2. With block diagrams explain about DPCM & DM. also compare them.
	Q3. A message signal m(t) = 4 cos ($2\pi 10^3$t) is sampled at nyquist rate and transmitted through a channel using 3-bit PCM system. i. Calculate all the parameters of the PCM. ii. If the sampled values are 3.8, 2.1, 0.5, -1.7, -3.2 & -4 then determine the quantizer output, encoder output andquantization error per each sample. iii. Sketch the transfer characteristics of the quantizer.

4EC4-21: Analog and Digital Communication Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**

0L+0T+3P

List of Experiments	
Sr. No.	**Name of Experiment**
1.	Observe the Amplitude modulated wave form & measure modulation index and demodulation of AM signal.
2.	Harmonic analysis of Amplitude Modulated wave form.
3.	Generation & Demodulation of DSB – SC signal.
4.	Modulate a sinusoidal signal with high frequency carrier to obtain FM signal and demodulation of the FM signal.
5.	Verification of Sampling Theorem.
6.	To study & observe the operation of a super heterodyne receiver.
7.	PAM, PWM & PPM: Modulation and demodulation.
8.	To observe the transmission of four signals over a single channel using TDM-PAM method.
9.	To study the PCM modulation & demodulation and study the effect of channel like attenuation, noise in between modulator & demodulator through the experimental setup.
10.	To study the 4 channel PCM multiplexing & de-multiplexing in telephony system.
11.	To study the Delta & Adaptive delta modulation & demodulation and also study the effect of channel like attenuation, noise in between modulator & demodulator through the experimental setup.
12.	To perform the experiment of generation and study the various data formatting schemes (Unipolar, Bipolar, Manchester, AMI etc.)
13.	To perform the experiment of generation and detection of ASK, FSK, BPSK, DBPSK signals with variable length data pattern.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-21	Analog and Digital Communication Lab	CO 1	Understand different analog modulation schemes and evaluate modulation index
		CO 2	Able to understand the principle of superhetrodyne receiver
		CO 3	Develop time division multiplexing concepts in real time applications
		CO 4	Develop and able to comprehend different data formatting schemes
		CO 5	Comprehend and analyze the concepts of different digital modulation techniques in communication.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-21 Analog and Digital Communication Lab	CO 1	3	2		1								
	CO 2	3	2	1									
	CO 3	3	3	2	2	1							
	CO 4	3	3	2	2	1							
	CO 5	3	3	2	2	1							

3: Strongly **2: Moderate** **1: Weak**

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4EC4-22: Analog Circuits Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**

0L+0T+3P

List of Experiments	
Sr. No.	**Name of Experiment**
1.	Study and implementation of Voltage Series and Current Series Negative Feedback Amplifier.
2.	Study and implementation of Voltage Shunt and Current Shunt Negative Feedback Amplifier.
3.	Plot frequency response of BJT amplifier with and without feedback in the emitter circuit and calculate bandwidth, gain bandwidth product with and without negative feedback.
4.	Study and implementation of series and shunt voltage regulators and calculate line regulation and ripple factor.
5.	Plot and study the characteristics of small signal amplifier using FET.
6.	Study and implementation of push pull amplifier. Measure variation of output power & distortion with load and calculate the efficiency.
7.	Study and implementation of Wein bridge oscillator and observe the effect of variation in oscillator frequency.
8.	Study and implementation of transistor phase shift oscillator and observe the effect of variation in R & C on oscillator frequency and compare with theoretical value.
9.	Study and implementation of the following oscillators and observe the effect of variation of capacitance on oscillator frequency: (a) Hartley (b) Colpitts.
10.	Study and implementation of the Inverting And Non-Inverting Operational Amplifier.
11.	Study and implementation of Summing, Scaling And Averaging of Operational Amplifier
12.	Implementation of active filters using OPAMP.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-22	Analog Circuits Lab	CO 1	Discuss and observe the operation of a bipolar junction transistor and field-effect transistor in different region of operations.
		CO 2	Analyze and design of transistor Amplifier and Oscillators. Importance of negative feedback.
		CO 3	Analyze the frequency response of amplifiers and operational amplifier circuits. Develop an intuition for analog circuit behavior in both linear and nonlinear operation.
		CO 4	Design op-amps for specific gain, speed, or switching performance. Compensate operational amplifiers for stability.
		CO 5	Design and conduct experiments, interpret and analyze data, and report results.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-22 Analog Circuits Lab	CO 1	3	2	1	2	2							
	CO 2	2	3	1	2	3							
	CO 3	1	3	2	3	2							
	CO 4	1	2	3	2	3							
	CO 5	1	2	3	3	3							

3: Strongly **2: Moderate** **1: Weak**

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4EC4-23: Microcontrollers Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**

0L+0T+3P

List of Experiments	
Sr. No.	**Name of Experiment**
Following exercises has to be Performed on 8085	
1.	Write a program for 1.1 Multiplication of two 8 bit numbers 1.2 Division of two 8 bit numbers
2.	Write a program to arrange a set of data in Ascending and Descending order.
3.	Write a program to find Factorial of a given number.
4.	Write a program to generate a Software Delay. 4.1 Using a Register 4.2 Using a Register Pair
8085 Interfacing Programs	
5.	5.1 Write a program to Interface ADC with 8085.
	5.2 Write a program to interface Temperature measurement module with 8085.
6.	Write a program to interface Keyboard with 8085.
7.	Write a program to interface DC Motor and stepper motor with 8085.
Following exercises has to be Performed on 8051	
8.	Write a program to convert a given Hex number to Decimal.
9.	Write a program to find numbers of even numbers and odd numbersamong 10 Numbers.
10.	Write a program to find Largest and Smallest Numbers among 10 Numbers.
11.	11.1 To study how to generate delay with timer and loop.
	11.2 Write a program to generate a signal on output pin using timer.
8051 Interfacing Programs	
12	12.1 Write a program to interface Seven Segment Display with 8051.
	12.2 Write a program to interface LCD with 8051.
13	Write a program for Traffic light Control using 8051.
14	Write a program for Elevator Control using 8051.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-23	Microcontrollers Lab	CO 1	Develop skills related to assembly level programming of microprocessors and microcontroller.
		CO 2	Interpret the basic knowledge of microprocessor and microcontroller interfacing, delay generation, waveform generation and Interrupts.
		CO 3	Interfacing the external devices to the microcontroller and microprocessor to solve real time problems.
		CO 4	Illustrate functions of various general purpose interfacing devices.
		CO 5	Develop a simple microcontroller and microprocessor based systems

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-23 Microcontrollers Lab	CO 1	2	1	2	1	3							
	CO 2	3	2	1	2	1							
	CO 3	1	1	3	1	3							
	CO 4	2	2	1									
	CO 5	1	1	3	2	2		2					

3: Strongly **2: Moderate** **1: Weak**

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4EC4-24: Electronics Measurement & Instrumentation Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**

0L+0T+3P

List of Experiments	
Sr. No.	**Name of Experiment**
1.	Measure earth resistance using fall of potential method.
2.	Plot V-I characteristics & measure open circuit voltage & short circuit current of a solar panel.
3.	Measure unknown inductance capacitance resistance using following bridges (a) Anderson Bridge (b) Maxwell Bridge
4.	To measure unknown frequency & capacitance using Wein's bridge.
5.	Measurement of the distance with the help of ultrasonic transmitter & receiver.
6.	Measurement of displacement with the help of LVDT.
7.	Draw the characteristics of the following temperature transducers (a) RTD (Pt-100) (b) Thermistors.
8.	Draw the characteristics between temperature & voltage of a K type thermocouple
9.	Calibrate an ammeter using D.C. slide wire potentiometer
10.	Measurement of strain/force with the help of strain gauge load cell.
11.	Study the working of Q-meter and measure Q of coils.
12.	Calibrate a single-phase energy meter (Analog and Digital) by phantom loading at different power factor by: (i) Phase shifting transformer (ii) Auto transformer.

Course Outcome:

Course Code	Course Name	Course Outcome	Details
4EC4-24	Electronic Measurement & Instrumentation Lab	**CO 1**	Understanding of the fundamentals of Electronic Instrumentation. Explain and identify measuring instruments.
		CO 2	Able to measure resistance, inductance and capacitance by various methods.
		CO 3	Design an instrumentation system that meets desired specifications and requirements.
		CO 4	Design and conduct experiments, interpret and analyze data, and report results.
		CO 5	Explain the principle of electrical transducers. Confidence to apply instrumentation solutions for given industrial applications.

CO-PO Mapping:

Subject	Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
4EC4-24 Electronic Measurement & Instrumentation Lab	**CO 1**	3	2	1	2	2							
	CO 2	2	3	1	2	3							
	CO 3	1	3	2	3	2							
	CO 4	1	2	3	2	3							
	CO 5	1	2	3	3	3							

3: Strongly **2: Moderate** **1: Weak**

5EC3-01: Computer Architecture

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Basic Structure of Computers, Functional units, software, performance issues software, machineinstructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Ques, Subroutines.	6
3	Processor organization, Information representation, number formats. Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating pointformats	5
4	Control Design, Instruction sequencing, Interpretation, Hard wired controlDesignmethods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit	6
5	Memory organizations, device characteristics, RAM, ROM, Memory management, Concept ofCache & associative memories, Virtual memory.	5
6	System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfacesConcept of parallel processing, Pipelining, Forms of parallel processing, interconnect network	5
	Total	28

5EC4-02: Electromagnetics Waves

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Transmission Lines-Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.	08
3	Maxwell's Equations-Basics of Vectors, Vector calculus, Basic laws of Electromagnetics,Maxwell's Equations, Boundary conditions at Media Interface.	03
4	Uniform Plane Wave-Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.	08
5	Plane Waves at a Media Interface-Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.	07
6	Waveguides- Wave propagation in parallel plate waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.	08
7	Radiation-Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna	07
	Total	42

5EC4-03: Control system

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulicservomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.	8
3	Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feedforward and multi-loop control configurations, stability concept, relative stability, Routhstability criterion.	7
4	Time response of second-order systems- steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.	6
5	Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquistplots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution.	8
6	State variable Analysis- Concepts of state, state variable, state model, state modelsfor linearcontinuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability &observability.	6
7	Introduction to Optimal control & Nonlinear control, Optimal Control problem, Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.	6
	Total	42

5EC4-04: Digital Signal Processing

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequency Analysis, Inverse Systems	10
3	Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems	9
4	Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR DigitalFilters: Butterworth, Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters.	10
5	Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to mult-irate signal processing. Application of DSP.	10
	Total	40

5EC4-05: Microwave Theory & Techniques

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.	4
3	Mathematical Model of Microwave Transmission-Concept of Mode, Features of TEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.	5
4	Analysis of RF and Microwave Transmission Lines-Coaxial line, Rectangularwaveguide, Circular waveguide, Strip line, Micro strip line.	4
5	Microwave Network Analysis-Equivalent voltages and currents for non-TEMlines, Networkparameters for microwave circuits, Scattering Parameters.	4
6	Passive and Active Microwave Devices-Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator.Microwave active components: Diodes, Transistors, Oscillators, Mixers.Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes.Microwave Tubes: Klystron, TWT, Magnetron.	6
7	Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave Antennas- Antenna parameters, Antenna for ground based systems, Antennas for airborne and satellite borne systems, Planar Antennas.	6
8	Microwave Measurements-Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzerand measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.	6
9	Microwave Systems-Radar, Terrestrial and Satellite Communication, Radio Aidsto Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.	6
	Total	**42**

5EC5-11: Bio-Medical Electronics

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Brief introduction to human physiology. Biomedical transducers: displacement,velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases.	9
3	Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG, etc.	7
4	Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging.Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped. Safety aspects.	11
	Total	28

5EC5-12: Embedded Systems

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	The concept of embedded systems design, Embedded microcontroller cores, embedded memories.	5
3	Examples of embedded systems, Technological aspects of embedded systems: interfacing between analog and digital blocks, signal conditioning, digital signal processing. Sub system interfacing, interfacing with external systems, user interfacing.	10
4	Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.	12
	Total	28

5EC5-13: Probability Theory & Stochastic Process

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.	5
3	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;	6
4	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;	6
5	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem	5
6	Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.	4
	Total	27

5EC5-14: Satellite Communication

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.	4
3	Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc. of a satellite, concepts of Solar day and Sidereal day.	4
4	Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems etc.	5
5	Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift. Satellite link budget	5
6	Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions.	4
7	Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access schemes based on time, frequency, and code sharing namely TDMA, FDMA and CDMA.	4
	Total	**27**

5EC4-21: RF Simulation Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**
0L+0T+3P **End Term Exam: 2 Hours**

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
2	Study of field pattern of various modes inside a rectangular and circular waveguide.
3	Find the change in characteristics impedance and reflection coefficients of the transmission line by changing the dielectric properties of materials embedded between two conductors.
4	Design and simulate the following Planar Transmission Lines: I. Strip and micro-strip lines II. Parallel coupled strip line III. Coplanar and Slot lines Determine their field patterns and characteristic impedance.
5	Design and simulate the following: I. 3-dB branch line coupler II. Wilkinson power divider III. Hybrid ring IV. Backward wave coupler V. Low pass filters VI. Band pass filters
6	Design RF amplifier using microwave BJT.
7	Design RF amplifier using microwave FET.

5EC4-22: Digital Signal Processing Lab

Credit: 1.5 **Max. Marks: 75(IA:45, ETE:30)**
0L+0T+3P **End Term Exam: 2 Hours**

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
2	Generation of continuous and discrete elementary signals (impulse,unit-step,ramp) using mathematical expression.
3	Perform basic operations on signals like adding, subtracting, shifting and scaling.
4	Perform continuous and discrete time Convolution (using basic definition).
5	Checking Linearity and Time variance property of a system using convolution, shifting.
6	To generate and verify random sequences with arbitrary distributions, means and variances for following: (a) Rayleigh distribution (b) Normal distributions: N(0,1). (c) Gaussion distributions: N (m, x) (d) Random binary wave.
7	To find DFT / IDFT of given DT signal.
8	N-point FFT algorithm.
9	To implement Circular convolution.
10	MATLAB code for implementing z-transform and inverse z-transform.
11	Perform inverse z-transform using residuez MATLAB function.
12	MATLAB program to find frequency response of analog LP/HP filters.
13	To design FIR filter (LP/HP) using windowing (rectangular, triangular, Kaiser) technique using simulink.

5EC4-23: Microwave Lab

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
2	Study of various microwave components and instruments like frequency meter, attenuator, detector and VSWR meter. (a) Measurement of guide wavelength and frequency using a X-band slotted line setup. (b) Measurement of low and high VSWR using a X-band slotted line setup.
3	Introduction to Smith chart, measurement of SWR, shift in minimum standing wave with unknown load and calculation of unknown load impedance using Smith chart.
4	Study the behavior of terminated coaxial transmission lines in time and frequency domain.
5	(a) Draw the V-I characteristics of a Gunn diode and determine the output power and frequency as a function of voltage. (b) Study the square wave modulation of microwave signal using PIN diode.
6	Study the square wave modulation of microwave signal using PIN diode.Study and measure the power division and isolation characteristics of a microstrip 3dB power divider.
7	Study of rat race hybrid ring (equivalent of waveguide Magic-Tee) in micro-strip.
8	(a) To study the characteristics of micro-strip 3dB branch line coupler, strip line backward wave coupler as a function of frequency and compare their bandwidth. (b) (b)Measure the microwave input, direct, coupled and isolated powers of a backward wave strip line coupler at the centre frequency using a power meter. From the measurements calculate the coupling, isolation and directivity of the coupler.

6EC3-01: Power Electronics

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	SEMICONDUCTOR POWER DEVICES: Introduction. Basic characteristics &working of Power Diodes, Diac, Triac, MOSFETs, IGBT, GTO, Power Transistor and SCR- Principle of operation, V-I Characteristics, Turn-On mechanism and its applications	6
3	CONVERTERS: Basic concept, Working Principles of Single phase half Wave bridge converter, Single Phase Full Bridge Converter, 3 Phase Bridge Converter	5
4	INVERTERS: Voltage Source Inverter, Current Source Inverter, PWM Control of Voltage Source Converter and applications.	5
5	INDUSTRIAL POWER SUPPLIES: Principle of operation of choppers. Step up, Step down and reversible choppers. Chopper control techniques, High frequency electronic ballast, Switch Mode Power Supply: Fly back converter, forward/buck converter, Boost converter and buck-boost converter. Uninterruptible Power Supply.	6
6	MOTOR CONTROL: Introduction to speed control of DC motors using phase controlled converters and choppers, Basic idea of speed control of three phase induction motors using voltage and frequency control methods.	5
	Total	28

6EC4-02: Computer Network

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Queuing Theory- Pure birth, Pure death & Birth-death processes, Mathematical models for M/M/1, M/M/ ∞ , M/M/m, M/M/1/K and M/M/m/m queues. Little's formula.	7
3	Introduction to computer networks and the Internet: Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic ail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts. Packet switching, Blocking in packet switches, Three generations of packet switches, switch fabric, Buffering, Multicasting, Statistical Multiplexing.	9
4	Transport layer: Connectionless transport - User Datagram Protocol, Connection oriented transport – Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.	9
5	Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing	7
6	Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.Fundamental of SDN, Open flow.	7
	Total	40

6EC4-03: Fiber Optics Communications

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to vector nature of light, propagation of light, propagation of light in a cylindricaldielectric rod, Ray model, wave model.Different types of optical fibers, Modal analysis of a step index fiber.	8
3	Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers andmeasurement techniques like OTDR	7
4	Optical sources - LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detectorresponsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties.	8
5	Optical switches - coupled mode analysis of directional couplers, electro-optic switches.Optical amplifiers - EDFA, Raman amplifier.	8
6	WDM and DWDM systems. Principles of WDM networks.Nonlinear effects in fiber optic links. Concept of self-phase modulation, groupvelocity dispersion and solition based communication.	8
	Total	40

6EC4-04: Antennas and Propagation

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Fundamental Concepts-Physical concept of radiation, Radiation pattern, near andfar-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions.	7
3	Radiation from Wires and Loops-Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop.	6
4	Aperture and Reflector Antennas-Huygens' principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.	7
5	Broadband Antennas-Log-periodic and Yagi-Uda antennas, frequency independent antennas, broadcast antennas.	5
6	Micro strip Antennas-Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas.	6
7	Antenna Arrays-Analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkun off polynomial method, Woodward-Lawson method.	5
8	Basic Concepts of Smart Antennas-Concept and benefits of smart antennas, fixed weight beamforming basics, Adaptive beam forming.	4
9	Different modes of Radio Wave propagation used in current practice.	1
	Total	42

6EC4-05: Information Theory and Coding

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Basics of information theory, entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources.	15
3	Markov sources; Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.	15
4	Techniques of coding and decoding; Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes.	10
	Total	41

6EC5-11: Introduction to MEMS

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction and Historical Background.	1
3	Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.	14
4	Scaling Effects. Micro/Nano Sensors, Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching.	14
5	Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.	10
	Total	40

6EC5-12: Nano Electronics

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.	15
3	Shrink-down approaches: Introduction, CMOS Scaling, The nano scale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).	10
4	Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors,Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation	14
	Total	40

6EC5-13: Neural Network And Fuzzy Logic Control

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	**NEUROPHYSIOLOGY:** Introduction: Elementary neurophysiology – From neurons to ANNs - Neuron model McCulloch-Pitts model, Hebbian Hypothesis; limitations of single-layered neural networks.Applications Of Neural Networks: Pattern classification, Associative memories, Optimization, Applications in Image Processing-Iris, finger print & face, Applications in decision making.	8
3	**THE PERCEPTRON:** The Perceptron and its learning law. Classification of linearly separable patterns. Linear Networks: Adaline - the adaptive linear element. Linear regression. The Wiener-Hopf equation. The Least-Mean-Square (Widrow-Hoff) learning algorithm. Method of steepest descent. Adaline as a linear adaptive filter. A sequential regression algorithm.Multi-Layer Feedforward Neural Networks: Multi-Layer Perceptrons. Supervised Learning. Approximation and interpolation of functions. Back-Propagation Learning law. Fast training algorithms. Applications of multilayer perceptrons: Image coding, Paint-quality inspection, Nettalk.	9
4	**FUZZY LOGIC:** Introduction -Uncertainty & precision, Statistics and random process, Uncertainty in information, Fuzzy sets and membership. Membership Functions: Features of membership function. Standard forms and boundaries, Fuzzification, Membership value assignment – Intuition, Inference, Neural networks. Fuzzy To Crisp Conversions: Maximum membership principle.	7
5	**DEFUZZIFICATION METHODS-** Centroid method, Weighted average method, Meanmax membership. Fuzzy Rule Based Systems: Natural language, linguistic hedges, Rule based system –Canonical rule forms, Decomposition of compound rules, Likelihood and truth qualification Aggregation of Fuzzy rules. Graphical techniques of reference.	8
6	**FUZZY CONTROL SYSTEM-** Simple Fuzzy Logic controller, General FLC, Control System Design Problem Control (Decision) Surface, Assumptions in a Fuzzy Control System Design, Special forms of FLC system models, Industrial application: Aircraft Landing Control Problem.Fuzzy Engineering Process Control: Classical Feedback Control, Classical PID Control, Multi-input, Multi-output (MIMO) Control Systems, Fuzzy Statistical Process Control	9
	Total	42

6EC5-14: High Speed Electronics

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact ofpackages, vias, traces, connectors; non-ideal return current paths, high frequency powerdelivery,methodologies for design of high speed buses; radiated emissions and minimizing system noise;Noise Analysis: Sources, Noise Figure, Gain compression, Harmonic distortion,Intermodulation,Cross-modulation, Dynamic range	10
3	Devices: Passive and active, Lumped passive devices (models), Active (models, low vs High frequency)	6
4	RF Amplifier Design, Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed)Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-overdistortion Efficiency RF power output stages	8
5	Mixers –Up conversion Down conversion, Conversion gain and spurious response. OscillatorsPrinciples.PLL Transceiver architectures	8
6	Printed Circuit Board Anatomy, CAD tools for PCB design, Standard fabrication, Micro viaBoards. Board Assembly: Surface Mount Technology, Through Hole Technology, ProcessControl and Design challenges.	8
	Total	41

6EC4-21: Computer Network Lab

Credit: 2 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 2 Hours**

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
2	PRELIMINARIES: Study and use of common TCP/IP protocols and term viz. telnet rlogin ftp, ping, finger, Socket, Port etc.
3	DATA STRUCTURES USED IN NETWORK PROGRAMMING: Representation of unidirectional, Directional weighted and unweighted graphs.
4	ALGORITHMS IN NETWORKS: computation of shortest path for one source-one destination and one source –all destination
5	SIMULATION OF NETWORK PROTOCOLS: i. Simulation of M/M/1 and M/M/1/N queues. ii. Simulation of pure and slotted ALOHA. iii. Simulation of link state routing algorithm.
6	Case study : on LAN Training kit i. Observe the behavior& measure the throughput of reliable data transfer protocols under various Bit error rates for following DLL layer protocols- a. Stop & Wait b. Sliding Window : Go-Back-N and Selective Repeat ii. Observe the behavior& measure the throughput under various network load conditions for following MAC layer Protocols a. Aloha b. CSMA, CSMA/CD & CSMA/CA c. Token Bus & Token Ring
7	Software and hardware realization of the following: i. Encoding schemes: Manchester, NRZ. ii. Error control schemes: CRC, Hamming code.

6EC4-22: Antenna and Wave Propagation Lab

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

SN	Contents
	PART-I (Antenna)
1	Study the gain pattern, HPBW, FNBW and Directivity of a dipole antenna.
2	Measurement of Radiation Pattern, Gain, HPBW of a folded dipole antenna.
3	Measurement of Radiation Pattern, Gain, HPBW of a loop antenna
4	Measurement of Radiation Pattern, Gain, VSWR, input impedance and reflection coefficient for given Monopole antenna
5	Measurement of Radiation Pattern, Gain, VSWR, input impedance and reflection coefficient for given Yagi antennas
6	Study of the Radiation Pattern, Gain, HPBW of a horn antenna
7	Study of the Radiation Pattern, Gain, HPBW of a reflector antennas
8	Study the radiation pattern, gain, VSWR, and input impedance of a rectangular microstrip patch antenna
9	Study the effect of inset feed on the input impedance of a rectangular patch antenna
10	Study the effect of ground plane on the radiation pattern of an antenna
11	Study antenna designing in CST Microwave Studio
12	Design a rectangular microstrip patch antenna using CST MWS
	PART-II (Optical Fiber) To perform following experiments based on Fiber Optic Trainer.
13	To set up Fiber Optic Analog link and Digital link.
14	Measurement of Propagation loss and numerical aperture.

6EC4-23: Electronics Design Lab

Credit: 2 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+4P **End Term Exam: 2 Hours**

SN	Contents
	To design the following circuits, assemble these on bread board and test them and Simulation of these circuits with the help of appropriate software.
1	Op-Amp characteristics and get data for input bias current measure the output-offset voltage and reduce it to zero and calculate slew rate.
2	Op-Amp in inverting and non-inverting modes.
3	Op-Amp as scalar, summer and voltage follower.
4	Op-Amp as differentiator and integrator.
5	Design LPF and HPF using Op-Amp 741
6	Design Band Pass and Band reject Active filters using Op-Amp 741.
7	Design Oscillators using Op-Amp (i) RC phase shift (ii) Hartley (iii) Colpitts
8	Design (i) Astable (ii) Monostable multivibrators using IC-555 timer
9	Design Triangular & square wave generator using 555 timer.
10	Design Amplifier (for given gain) using Bipolar Junction Transistor.
11	Op-Amp characteristics and get data for input bias current measure the output-offsetvoltage and reduce it to zero and calculate slew rate.
12	Op-Amp in inverting and non-inverting modes.
13	Op-Amp as scalar, summer and voltage follower.

6EC4-24: Power Electronics Lab

Credit: 1 **Max. Marks: 50(IA:30, ETE:20)**
0L+0T+2P **End Term Exam: 2 Hours**

SN	Contents
1	Study the characteristics of SCR and observe the terminal configuration, Measure the breakdown voltage, latching and holding current. Plot V-I characteristics.
2	Perform experiment on triggering circuits for SCR. i.e. R triggering, R-C triggering and UJT triggering circuit.
3	Study and test AC voltage regulators using triac, antiparallel thyristors and triac&diac.
4	Study and obtain the waveforms for single-phase bridge converter.
5	Perform experiment on single phase PWM inverter.
6	Perform experiment on buck, boost and buck-boost regulators.
7	Control speed of a dc motor using a chopper and plot armature voltage versus speed characteristic.
8	Control speed of a single-phase induction motor using single phase AC voltage regulator.
9	I. Study single-phase dual converter. II. Study speed control of dc motor using single-phase dual converter.
10	Study single-phase cyclo converter.
11	Perform experiment on Motor control – open loop & closed loop
12	Design, observe and perform experiment on various type of pulse generation from DSP/ FPGA Platform. Perform experiment for PWM inverters and choppers.

7EC5-11: VLSI Design (program elective-3)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	INTRODUCTION TO MOSFET- Basic MOS transistors, Enhancement Mode transistor action, Depletion Mode transistor action, NMOS and CMOS fabrication. Aspects of threshold voltage, threshold voltage with body effect. I_{ds} versus V_{ds} relationship, channel length modulation. Transistor Trans-conductance g_m. MOS transistor circuit Model, Model parameter (oxide and junction capacitor, channel resistance) variation with scaling and biasing. High order effects (i.e. sub threshold conduction, hot electron effect, narrow channel effect and punch through effect.	12
3	CMOS LOGIC CIRCUITS- NMOS inverter (resistive and active load), Pull up to Pull-down ratio(β_p/β_n) for a NMOS Inverter and CMOS Inverter, determination of inverter parameter (VIL, VIH VOL VOH) and Noise Margin. Speed and power dissipation analysis of CMOS inverter. Combinational Logic, NAND Gate, NOR gate, XOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate (TG), estimation of Gate delays, Power dissipation and Transistor sizing. Basic physical design of simple Gates and Layout issues. Layout issues for CMOS inverter, Layout for NAND, NOR and Complex Logic gates, Layout of TG, Layout optimization using Eular path. DRC rules for layout and issues of interconnects, Latch up problem.	11
4	Dynamic CMOS circuits- Clocked CMOS (C^2MOS) logic, DOMINO logic, NORA logic, NP(ZIPPER) logic, PE (pre-charge and Evaluation) Logic. Basic Memory circuits, SRAM and DRAM.	08
5	Physical Design- Introduction to ECAD tools for front and back end design of VLSI circuits. Custom /ASIC design, Design using FPGA and VHDL. VHDL Code for simple Logic gates, flip-flops, shift registers.	08
	Total	40

Text/Reference Books:	
1	Cmos Digital Integrated Circuits Analysis And Design. Sung-Mo (Steve) Kang, Yusuf Leblebigi, McGraw Hill (2008)
2	N.Weste and K. Eshraghian, Principles of CMOS VLSI, 2e, Pearson Education, 2011
3	VLSI Design, P PSahu , , McGraw, 2013
4	VLSI Design, D.P. Das, Oxford, 2011
5	Chip Design for Submicron VLSI: CMOS Layout & Simulation, Uyemura, cengage learning, 2009

7EC5-12: Mixed Signal Design(program elective-3)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.	10
3	Basic logic gates with BJT and MOSFET combination, Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.	07
4	Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.	08
5	Mixed-signal layout, Interconnects and data transmission; Voltage-mode signal aligned data transmission; Current-mode signaling and data transmission.	08
6	Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs	06
	Total	40

Text/Reference Books:	
1.	R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008.
2.	Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003.
3.	R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008.
4.	Rudy V. de Plassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005.
5.	Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
6.	R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer additions).
7.	M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford university press, first Indian edition, 2008.

7EC5-13: CMOS Design (program elective-3)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, Transistor as a switch, Inverter characteristics	08
3	Integrated Circuit Layout: Design Rules, Parasitic, Delay: RC Delay model, linear delay model, logical path efforts, Power, interconnect and Robustness in CMOS circuit layout	07
4	Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. NAND Gate, NOR gate, XOR gate, Compound Gates, 2 input CMOS Multiplexer, Memory latches and registers, Transmission Gate, estimation of Gate delays, Power dissipation and Transistor sizing. Basic physical design of simple Gates and Layout issues. Layout issues for CMOS inverter, Layout for NAND, NOR and Complex Logic gates,	10
5	Dynamic CMOS circuits- Clocked CMOS (C^2MOS) logic, DOMINO logic, NORA logic, NP(ZIPPER) logic, PE (pre-charge and Evaluation) Logic. Basic Memory circuits, SRAM and DRAM.	08
6	Physical Design- Introduction to ECAD tools for first and back end design of VLSI circuits. Custom /ASIC design, Design using FPGA and VHDL. VHDL Code for simple Logic gates, flip-flops, shift registers.	06
	Total	40

Text/Reference Books:

1.	N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, 2011.
2.	Sung-Mo-Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis &Design, McGraw Hill
3.	C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
4.	J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
5.	P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
6.	L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

7EC4-21: VLSI Design Lab

Credit: **Max. Marks: 100(IA:60, ETE:40)**

0L+0T+4P

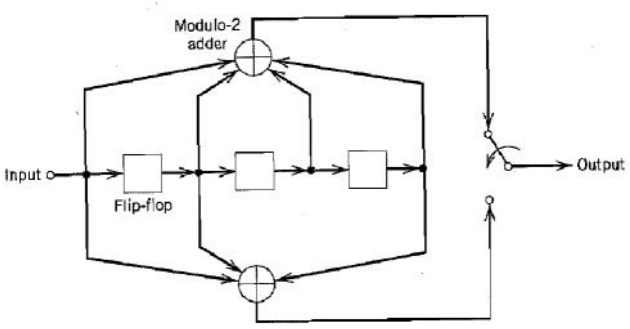
SN	Contents
1	Introduction: Objective, scope and outcome of the course.
PART-A	Step1 Write the VHDL/Verilog code using VHDL software for following experiment and simulate them. Step 2. Burn the Written code in Xilling Board and test the output with real input signal
1	Design and simulate all the logic gates with 2 inputs using VHDL/Verilog.
2	Design and simulate 2-to-4 decoder,3-to-8 encoder and 8X1 multiplexer using VHDL/Verilog.
3	Design and simulate half adder and full adder using VHDL (data flow method)/Verilog.
4	Design and simulate D, T and J-K flip flop using VHDL/Verilog.
5	Design a 4bit binary Asynchronous and synchronous counter. Obtain its number of gates, area, and speed and power dissipation.
6	Design a 4- bit Serial in-serial out shift register. Obtain its number of gates, area, and speed and power dissipation.
PART-B	Step-1 Design and simulate following experiment using ECAD software Viz. Mentor graphics, Orcade Pspice, Cadence etc. Step-2 Draw the layout (without any DRC error)of the schematic obtain in step 1 and obtain post layout simulation using appropriate ECAD software.
1	Design and simulate all the logic gates (NOT, NAND and NOR) with 2 inputs in CMOS Technology.
2	Design and simulate Y = AB (C+D), Y = A+B(C+D) and 4X1 multiplexer using CMOS Technology.
3	Design and simulate half adder and full adder using CMOS Technology.
4	Design and simulate SR flip flop using CMOS Technology.
5	Design and Simulate any DRAM cell.

7EC4-22: Advance Communication Lab (MATLAB Simulation)

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**

0L+0T+2P

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
Part-A	**Analog-to-digital conversion** 1. Generate a sinusoidal signal. Sample and reconstruct a signal through interpolation. Vary the sampling rate below and above the Nyquist rate and hence verify the Sampling theorem. 2. Generate a sequence of length 500 of zero-mean, unit variance Gaussian random variables. Using a uniform PCM scheme, quantize this sequence to 16, 64 and 128 levels. (a). Find and compare the resulting signal-to-quantization noise ratios. (b). Find the first ten values of the sequence, the corresponding quantized values and the corresponding code words for each case. (c). Plot the quantization error and the quantized value as a function of the input value for each case. **Digital modulation techniques** 3. Simulate the transmitter and receiver for QPSK. Plot the signal and signal constellation diagram. Plot the average probability of symbol error as a function of SNR E_b/N_o, where E_b is the transmitted energy per bit and $N_o/2$ is the double sided power spectral density of additive white Gaussian noise (AWGN) with zero mean. 4. Simulate the transmitter and receiver for 16-QAM. Plot the signal and signal constellation diagram.Plot the average probability of symbol error as a function of SNR E_b/N_o, where E_b is the transmitted energy per bit and $N_o/2$ is the double sided power spectral density of additive white Gaussian noise (AWGN) with zero mean.
PART-B Attempt any four experiment	1. Find all the code words of the (15,11) Hamming code and verify that its minimum distance is equal to 3. 2. Generate an equiprobable random binary information sequence of length 15. Determine the output of the convolutional encoder shown below for this sequence.



3. Generate the L=31 Gold sequences. Consider a time-synchronous CDMA system (direct sequence spread spectrum) having four users, each employing a distinct Gold sequence of length L=31 and the binary (±1) modulation of their representative Gold sequences. The receiver for each user correlates the composite CDMA received signal, which is corrupted by AWGN (added on a chip-by-chip basis) with each user's respective sequence. Using 10000 information bits, estimate and plot the probability of error for each user as a function of SNR.
4. Consider a MIMO (multiple-input, multiple-output) system with $N_T = 2$ transmit antennas and NR = 2 receive antennas. Generate the elements of the channel matrix **H** for a Rayleigh fading (frequency nonselective) AWGN channel and the corresponding inputs to the detectors for the two receive antennas.
5. Perform feature extraction from a given Image and use Principal Components as image descriptors.
6. By using an image dataset, train a Neural Network to recognize a given Image. Apply this in context to face/object recognition and calculate recognition accuracy of the training set.
7. Develop a Fuzzy Inference System (FIS) by using a set of fuzzy rule base between some key image parameters and calculate output after defuzzification.
8. Design a Fuzzy PID controller using Matlab for a Dc Motor.
9. Classify ECG signals using Neural networks.

7EC4-23: Optical Communication Lab

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**

0L+0T+2P

SN	Contents
1	Introduction: Objective, scope and outcome of the course.
	Hardware based experiment;
1	To set up Fiber Optic Analog and fiber Optic Digital link.
2	Measurement of Propagation loss and numerical aperture.
3	Measurement of optical power bending loss in a plastic optical fiber.
4	Study and measure characteristics of fiber optic LED's, LDR and Laser diode.
5	OTDR Measurement of Fiber Length, Attenuation and Dispersion Loss.
	Software based experiment;
6	Design and simulate of single and multimode transmission in optical fiber system.
7	Show and simulate the optical system performance analysis using Eye diagram and measure the value of Q-factor & BER of optical signals.
8	Study and simulate the linear and parabolic waveguide structure use in optical fiber communication.
9	Design and simulate the Dispersion compensators for fiber optic communication.
10	Design and calculate the power budget for optical communication link.
11	Design and simulate the DWDM and WDM techniques use in optical communication.
12	Design and simulate the Fiber Bragg grating and find its transmission characteristics and optical band-gap.

8EC5-11: ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS
(program elective-4)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	**Introduction to Artificial Intelligence:** Intelligent Agents, State Space Search, Uninformed Search, Informed Search, Two Players Games, Constraint Satisfaction Problems.	08
3	**Knowledge Representation:** Knowledge Representation And Logic, Interface in Propositional Logic, First Order Logic, Reasoning Using First Order Logic, Resolution in FOPL.	07
4	**KNOWLEDGE ORGANIZATION:** Rule based System, Semantic Net, Reasoning in Semantic Net Frames, Planning	08
5	**KNOWLEDGE SYSTEMS:** Rule Based Expert System, Reasoning with Uncertainty, Fuzzy Reasoning.	08
6	**KNOWLEDGE ACQUISITION:** Introduction to Learning, Rule Induction and Decision Trees, Learning Using neural Networks, Probabilistic Learning Natural Language Processing.	08
	Total	40

Text/Reference Books:

1.	Elaine Rich and Kevin Knight, Artificial Intelligence 3/e, TMH (1991)
2.	PADHY: ARTIFICIAL INTELLIGENCE & INTELLIGENT SYSTEMS, Oxford (2005)
3.	James A Anderson, An introduction to Neural Networks. Bradford Books 1995
4.	Dan. W Patterson, Artificial Intelligence and Expert Systems, PHI 1990
5.	Kumar Satish, "Neural Networks" Tata Mc Graw Hill 2004
6.	S. Rajsekaran& G.A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India. 2006
7.	SimanHaykin, "Neural Netowrks" Prentice Hall of India 1990
8.	Artificial Intelligence, Kaushik, cengage learning 1997

8EC5-12: Digital Image and Video Processing (program elective-4)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**
3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	Digital Image Fundamentals-Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels neighborhood, adjacency, connectivity, distance measures.	04
3	Image Enhancements and Filtering-Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.	03
4	Color Image Processing-Color models–RGB, YUV, HSI; Color transformations-formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.	04
5	Image Segmentation- Detection of discontinuities, edge linking and boundary detection, Thresholding – global and adaptive, region-based segmentation.	04
6	Wavelets and Multi-resolution image processing- Uncertainty principles of Fourier Transform, Time-frequency localization, continuous wavelet transforms, wavelet bases and multi-resolution analysis, wavelets and Sub-band filter banks, wavelet packets.	06
7	Image Compression-Redundancy–inter-pixel and psycho-visual; Lossless compression – predictive, entropy; Lossy compression-predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.	06
8	Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X.	06
9	Video Segmentation- Temporal segmentation–shot boundary detection, hard-cuts and soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.	06
	Total	40

Text/Reference Books:	
1.	R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2	R.C. Gonzalez, R.E. Woods and S.L. Eddins, Digital Image Processing using Matlab, McGraw Hill,2nd Edition
3.	Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India.2nd edition 2004
4.	Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

8EC5-13: Adaptive Signal Processing (program elective-4)

Credit: 3 **Max. Marks: 150(IA:30, ETE:120)**

3L+0T+0P **End Term Exam: 3 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	01
2	General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.	08
3	Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued The LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment Variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.	07
4	Signal space concepts - introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces.	08
5	Vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.	08
6	Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.	08
	Total	40

Text/Reference Books:	
1.	S. Haykin, Adaptive filter theory, Prentice Hall, 1986.
2.	C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984.

8EC4-21: IOT Lab

Credit: 1 **Max. Marks: 50 (IA:30, ETE:20)**
0L+0T+2P

	LIST OF PRACTICALS
1.	Study the fundamental of IOT softwares and components.
2.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
3.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
4.	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
5.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
6.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
7.	To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
8.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
9.	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.
10	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.
11.	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.
12.	To install MySQL database on Raspberry Pi and perform basic SQL queries.
13.	Write a program to create UDP server on Arduino/Raspberry Pi and respond with humidity data to UDP client when requested.
14.	Write a program to create TCP server on Arduino/Raspberry Pi and respond with humidity data to TCP client when requested.

	LIST OF SUGGESTED BOOKS:
1.	Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands on Approach", University Press.
2.	Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs.
3.	Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4.	Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5.	Adrian McEwen, "Designing the Internet of Things", Wiley
6.	Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

8EC4- 22 Skill Development Lab

Credit: 1 **Max. Marks : 50 (IA:30,ETE:20)**

0L+0T+2P

Part A: Training	
SN	**Contents**
1	Introduction: Objective, scope and outcome of the lab.
	Every student has to learn any two software from the following list, with consultation of their lab in charge. Students may get online certification or is advised to learn these from available freeware. Students may register online training courses from institutes of repute i.e. IITs/NITs/AICTE/MHRD, etc. Industrial experts /professional may be deputed to train the students in department.
1	Network simulator (NS_2)
2	Lab view
3	Software for Robotics/Artificial intelligence (AI) /machine learning
4	Java
5	Python

PART B: Implementation	
SN	**Contents**
1	**Student has to complete any one assignment with detailed project report based on the software/tool learn in part A.**
2	Student cab select any Social engineering project: Any problem of the society can be taken which can be solved with the help of electronics engineering software and gadgets.
3	Student can select Startup for innovation/entrepreneurship.
4	Engineering solution of any Industrial problem. Sufficient number of such problem may be identified by the department from nearby industry and may be given to the student for innovative solutions under guidance of faculty.
	This lab may be evaluated by an external examiner from industry along with internal faculty.