छत्रपति शाहू जी महाराज विश्वविद्यालय, कानपुर

CHHATRAPATI SHAHU JI MAHRAJ UNIVERSITY, KANPUR

(पूर्ववर्ती कानपुर विश्वविद्यालय कानपुर)

Formerly Kanpur University, Kanpur – 208024

A Documentary Support

For

Metric No. – 1.1.1

Programme Outcomes & Course Outcomes

Under the

Criteria - I

(Curriculum Design and Development)

Key Indicator - 1.1

In

Metric No. – 1.1.1

B. Tech. (Electronics & communication Engineering)

Co-ordinator
Internal Quality Assurance Cell
CSJM University, Kanpur

(Registrar)
C.S.J.M.University
Kanpur

REGISTRAR
C.S.J.M. UNIVERSITY
KANPUR

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY

KANPUR

SYLLABUS

(B.Tech.)

ELECTRONICS & COMMUNICATION ENGINEERING

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

UNIVERSITY INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

To achieve excellence in engineering education, empower students to be technically competent professionals and entrepreneurs with strong ethical values so as to significantly contribute as agents for universal development and societal transformation

Mission

To provide affordable quality education at par with global standards of academia and serve society with harmonious social diversity

To encourage new ideas and inculcate an entrepreneurial attitude amongst the students, and provide a robust research ecosystem

To practice and encourage high standards of professional ethics and accountability among students

Bachelor of Technology in Electronics & Communication Engineering

Program Outcomes (POs)

PO1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for engineering problems & design system components or processes that meet the specified needs with appropriate consideration for the public health, safety, and cultural, societal, and environmental considerations.
PO4	**Conduct investigation of complex problems:** Use research -based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create , select , and apply appropriate techniques , resources , and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO-1	To be able to understand problem, think of best suitable approach to solve the problem, develop and evaluate effective solutions as per the local/ regional/ national/ global requirements and availability of resources/ technologies.
PSO-2	To be able excel in contemporary technologies being adopted by the industry and academia for providing sustainable solutions
PSO-3	To be able to excel in various signal processing concepts/ project competitions and technological challenges laid by professional bodies

Program Educational Outcomes (PEOs)

PEO-1	**Circuit Design Concepts:** Apply basic and advanced electronics for implementing and evaluating various circuit configurations.
PEO-2	**VLSI and Signal Processing Domain:** Demonstrate technical competency in the design and analysis of components in VLSI and Signal Processing domains globally.
PEO-3	**Communication Theory and Practice:** Possess application-level knowledge in theoretical and practical aspects required for the realization of complex communication systems.

Curricular Components

Category of courses	Credits offered
Basic Science Core	**39**
Engineering Science Core	**28**
Humanities and Social Science Core	**13**
Departmental Core	**89**
Departmental/Open Electives	**8**
Projects and Seminars	**16**
Total	**193**

Semester-wise Course Structure

1st Year - Semester 1

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	MTH –S101	Mathematics – I	3	1	0	4
2	PHY -S101T	Physics – I	3	1	0	3
3	PHY -S101P	Physics Lab-I	0	0	3	2
4	TCA –S101	Engineering Drawing	0	2	4	5
5	HSS –S101	Communicative English	3	1	0	4
6	ESC –S101T	Basic Electrical & Electronics Engineering	3	1	0	3
7	ESC –S101P	Basic Electrical & Electronics Engineering Lab	0	0	3	2
8	UHV –S101	Universal Human Values-I (SIP)				
		Total	**12**	**6**	**10**	**23**

1st Year - Semester 1I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	MTH –S102	Mathematics–II	3	1	0	4
2	PHY -S102T	Physics–II	3	1	0	3
3	PHY -S102P	Physics Lab-II	0	0	3	2
4	ISC –S101T	Programming & Computing (C & UNIX)	3	0	0	3
5	ISC –S101P	Programming Lab (C & UNIX)	0	0	3	2
6	TCA –S102T	Workshop Concepts	1	1	0	2
7	TCA –S102P	Workshop Practice	0	0	3	3
8	CHM –S101T	Chemistry–I	3	0	0	3
9	CHM –S101P	Chemistry Lab–I	0	0	3	2
		Total	**13**	**3**	**12**	**24**

2nd Year - Semester II1

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	MTH –S201	Mathematics–III	3	1	0	4
2	ESC –S202	Thermodynamics	3	1	0	4
3	ESC –S201	Engineering Mechanics	3	1	0	4
4	ECE –S201T	Analog Electronics	3	1	0	3
5	ECE –S201P	Analog Electronics Lab	0	0	2	2
6	ECE –S202	Network Analysis and Synthesis	3	1	0	4
7	SST –S201	Summer Training	0	0	3	2
		Total	**15**	**5**	**5**	**23**

2nd Year - Semester IV

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	HSS –S401	Industrial Economics	3	1	0	4
2	MTH –S301	Mathematics-II	3	1	0	4
3	ECE –S203T	Digital Electronics	3	0	0	3
4	ECE –S203P	Digital Electronics Lab	0	0	3	2
5	ECE –S204T	Electrical Machine	3	0	0	3
6	ECE –S204P	Electrical Machine Lab	0	0	3	2
7	ECE –S205	Electromagnetic Theory	3	1	0	4
8	EVS –S101	Environmental Science	2	0	0	2
9	UHV –S201	Universal Human Values-II	2	1	0	3
		Total	**19**	**4**	**6**	**27**

3rd Year - Semester V

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	HSS –S301	Professional Communication	3	1	0	4
2	ECE –S301	Electronics Circuit	3	1	0	4
3	ECE –S302	Signal and Systems	3	1	0	4
4	ECE –S303T	Measurement and Instrumentation	3	0	0	3
5	ECE –S303P	Measurement and Instrumentation Lab	0	0	2	1
6	ECE –S304T	Microprocessor	3	0	0	3
7	ECE –S304P	Microprocessor Lab	0	0	3	2
8	ECE –S305	Electrical Engineering Materials	3	1	0	4
9	SST –S301	Student Summer Training	0	0	3	2
		Total	**18**	**4**	**8**	**27**

3rd Year - Semester VI

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ECE –S306	Automatic Control System	3	1	0	4
2	ECE –S307T	Analog Integrated Circuit	3	0	0	3
3	ECE –S307P	Analog Integrated Circuit Lab	0	0	3	2
4	ECE –S308T	Communication System	3	0	0	3
5	ECE –S308P	Communication System Lab	0	0	3	2
6	ECE –S309	Antenna and Microwave Engineering	3	1	0	4
7	ECE –S50X	Departmental/Open Elective-I	3	1	0	4
8	SSM –S301	Student Seminar	0	0	3	2
		Total	**15**	**3**	**9**	**24**

4th Year - Semester VII

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	HSS –S201	Industrial Management	3	0	0	4
2	ECE –S401T	Digital Communication	3	0	0	3
3	ECE –S401P	Digital Communication Lab	0	0	3	2
4	ECE –S402	Data Communication	3	1	0	4
5	ECE –S403T	Digital Signal Processing	3	0	0	3
6	ECE –S403P	Digital Signal Processing Lab	0	0	3	2
7	SST –S401	Summer Training	0	0	3	2
8	PRT –S401	B.Tech. Project I	0	0	6	4
		Total	**12**	**1**	**15**	**24**

4th Year - Semester VIII

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ECE –S404T	Wireless and Mobile Communication	3	0	0	3
2	ECE –S404P	Wireless and Mobile Communication Lab	0	0	3	2
3	ECE –S405T	Optical Communication	3	0	0	3
4	ECE –S405P	Optical Communication Lab	0	0	2	1
5	ECE –S406	VLSI Design and Technology	3	1	0	4
6	ECE –S5XX	Departmental Elective-II	3	1	0	4
7	PRT –S402	B.Tech. Project II	0	0	6	4
		Total	**12**	**2**	**11**	**21**

Total Credits – 193

NOTE: Total No. of Lectures in each course should in the range of 40 to 45 per semester if per week three lectures are allotted.

List of Departmental Elective Courses

Elective-I

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ECE –S501	Power Electronics	3	1	0	4
2	ECE –S502	Microprocessor based Instrumentation System	3	1	0	4
3	ECE –S503	Multimedia Communication	3	1	0	4
4	ECE –S504	T.V. Engineering	3	1	0	4
5	ECE –S505	Artificial Intelligence	3	1	0	4
6	ECE –S506	Advanced Semiconductor Devices	3	1	0	4

Elective-II

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ECE –S507	Information Theory and Coding	3	1	0	4
2	ECE –S508	Satellite Communication and Radar	3	1	0	4
3	ECE –S509	Digital Image Processing	3	1	0	4
4	ECE –S510	Artificial Neural Networks	3	1	0	4
5	ECE –S511	Biomedical Instruments	3	1	0	4
6	ECE –S512	Advanced Microprocessor	3	1	0	4
7	ECE –S513	Radar and Navigation	3	1	0	4

List of Open Elective Courses offered by ECE

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	ECE –S403	Digital Signal Processing	3	0	3	5
2	ECE –S406	VLSI Design and Technology	3	1	0	4
3	ECE –S511	Biomedical Instruments	3	1	0	4

List of Open Elective Courses offered by other Department

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	CSE –S204	Object Oriented Programming (Using Java)	3	0	3	5
2	CSE –S401	Computer Graphics	3	2	0	5
3	CSE –S510	Crypto Graphy and Network Security	3	1	0	4
4	ECE –S524	Python Programming	2	1	3	4

Detailed Syllabus of B.Tech Program Courses

Course Code: MTH-S101 **Breakup: 3 –1 – 0 – 4**
Course Name: Mathematics-I

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Test the convergence & divergence of infinite series
CO2	Understand concepts of limit, continuity and differentiability of function of two variables
CO3	Find the maxima and minima of multivariable functions
CO4	Evaluate multiple integrals, concepts of beta & gamma functions
CO5	Apply the concepts of gradient, divergence and curl to formulate engineering problems

Course Details:

Unit-I
Sequences & Series: Definition, Monotonic sequences, Bounded sequences, Convergent and Divergent Sequences Infinite series, Oscillating and Geometric series and their Convergence, n^{th} Term test, Integral test, Comparison Test, Limit Comparison test, Ratio test, Root test, Alternating series, Absolute and Conditional convergence, Leibnitz test.

Unit II
Differential Calculus: Limit Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations, Tangent plane and normal. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers**.**

Unit III
Integral Calculus: Review of curve tracing, Double and Triple integrals, Change of order of integration. Change of variables. Gamma and Beta functions, Dirichlet's integral; Applications of Multiple integrals such as surface area, volumes

Unit –IV
Vector Calculus: Differentiation of vectors, gradient, divergence, curl and their physical meaning; Identities involving gradient, divergence and curl Line and surface integrals Green's, Gauss and Stroke's theorem and their applications

Unit–V
Probability and Statistics: Concept of probability, random variable and distribution function: discrete and continuous, Binomial, Poisson and Normal Distributions.

Text Books:

1. G.B. Thomas and R.L. Finney: Calculus and Analytical Geometry, 9th edition, Pearson Education, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, 9th edition, John Wiley and Sons, Inc., U.K. 2011.
2. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 2nd Edition, Narosa Publishing House. 2005.
3. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, 11th Edition, Pearson Education.2008.

Course Code: PHY-S101 **Breakup: 3 –1 – 3 – 5**
Course Name: Physics-I

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the behaviour of Physical bodies
CO2	Understand the basic concepts related to the motion of all the objects around us in our daily life
CO3	Gain the foundation for applications in various applied fields in science and technology
CO4	Understand the concepts of vectors, laws of motion, momentum, energy, rotational motion, central force field, gravitation, collision and special theory of relativity
CO5	Empower the students to develop the skill of organizing the theoretical knowledge and experimental observations into a coherent understanding

Course Details: (Theory)

Unit 1
Revision of vectors, vector differentiation, ordinary derivatives of vectors, space curves continuity and differentiability, partial derivatives of vectors, gradient, divergence, curl, vector differentiation and their geometrical interpretation, various coordinate systems: polar coordinate, orthogonal curvilinear coordinate system, unit vectors and tangent vectors in curvilinear systems, special orthogonal curvilinear coordinate system, cylindrical coordinate system and spherical polar coordinate systems.

Unit 2
Inertial and non-inertial frames, fictitious force, Coriolis force, Newton's laws of motion and its applications, friction, conservative and non-conservative force, work energy theorem, conservation of linear momentum and energy, variable mass system (Rocket motion), simple harmonic motion, small oscillation, equilibrium, condition for stability of equilibrium, energy diagram, small oscillation in a bound system, working of Teeter toy.

Unit 3
Concept of center of mass and calculation of center of mass for different objects, system of particles and collision, conditions for elastic and inelastic collision, collision in center of mass frame, rigid body kinematics, rotational motion, moment of inertia, theorems on moment of inertia, calculation of moment of inertia of bodies of different shapes.

Unit 4
Central force field, properties of central force field, inverse square law force, gravitational field and potential; Kepler's laws of planetary motion and its application
Wave mechanics, wave particle duality, De-Broglie matter wave, Schrodinger wave equations (time dependent and time independent), uncertainty principle and its applications

Unit 5
Frame of reference, Galilean transformation, Michelson-Morley experiment, postulates of special theory of relativity, Lorentz transformations, Length contraction, time dilation, velocity addition theorem, variation of mass with velocity, Einstein's mass energy relation, relativistic relation between energy and momentum, rest mass of photon.

Text Books:

1. Vector Analysis by M. R. Spiegel, Schaum's Outlines, 2021
2. Introduction to Mechanics: R. D. Kleppner and J. Kolenkow, CambridgeUniversity Press, 2nd edition, 2014
3. A textbook of Mechanics by J. C. Upadhyay,Ram Prasas Publications; 1st edition, 2017
4. Mechanics by D. S. Mathur, S. Chand; New edition, 2000
5. Theory & ProblemsofTheoretical Mechanics by M. R. Spiegel, Schaum's Outline Series, 2017

References:

1. Introduction to Special Theory of Relativity by Robert Resnick, Wiley, 1st edition 2007.
2. Concept of physics (Part-I) by H. C. Verma, Bharti Bhawan Publisher, 2022.
3. Quantum Mechanics by L.I. Schiff, McGraw-Hill Education (India) Pvt Limited, 2017.
4. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, McGraw-Hill Education (India) Pvt Limited,2010.
5. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press, 2018.

Course outcomes (CO): At the end of the lab course, the student will be able to:

CO1	Perform basic experiments related to mechanics
CO2	Be familiar with various measuring instruments and also would learn the importance of accuracy of measurements.

Course Details: (Practical)

1. Graphical Analysis (Ref. UIET Laboratory Manual)
2. Trajectory of projectile (Ref. UIET Laboratory Manual) Apparatus Used (Trajectory Apparatus, Metal Balls, Channels, Vernier Callipers, Carbon & Graph Paper)
3. Moment of Inertia of Bicycle wheel (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Bicycle Wheel, Masses, Thread, Stopwatch, Meter Scale, Vernier Callipers)
4. Spring Oscillations (Ref. UIET Laboratory Manual) Apparatus Used (Spring Oscillation Apparatus, Stop Watch, Masses)
5. Coupled Pendulum (Ref. UIET Laboratory Manual) Apparatus Used (Coupled Pendulum Setup, Stop Watch, Scale)
6. Bifilar Suspension System (Ref. UIET Laboratory Manual) Apparatus Used (Bifilar Suspension System Setup, Stop Watch, Masses)
7. Frequency of AC Mains by Melde's Method (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Electrical Vibrator, String, Pulley, Small Pan, Weight Box & Physical Balance)
8. Kater's (Reversible) Pendulum (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Kater's Pendulum, Stop Watch)
9. Inertia Table (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Inertia Table, Stop Watch, Vernier Callipers, Split Disc, Balancing Weights, and Given Body (Disc))
10. Moment of Inertia of Flywheel (Ref. Book by J. C. Upadhyay and UIET Laboratory Manual) Apparatus used (Fly wheel, weight hanger, slotted weights, stop watch, metre scale)

Course Code: TCA-S101 **Breakup: 0 –2 – 4 – 5**
Course Name: Engineering Drawing

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the basics of engineering graphics
CO2	Develop skills to prepare basic engineering drawings
CO3	Understand the concept of projection and acquire visualization skills
CO4	Gain imaginative skills to understand section of solids and developments of surfaces

Course Details:

Introduction-Drawing instruments and their uses, BIS conventions, lettering dimensioning and free-hand practicing

Orthographic projections: Lines, planes and surfaces of objects, Sectional views, Auxiliary views, Space geometry: lines and planes, True lengths and shapes, Properties of parallelism, Perpendicularity and intersections of lines and planes, Simple intersections of solids and development of lateral simple solids

Isometric Projections: Introduction isometric scale, isometric projection of simple plane figures, isometric projection of tetrahedron, hexahedron(cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combinations of solids.

Introduction to computer graphics: Some problems on above topics on computer graphics.

Text Books:

1. Vector Analysis by M. R. Spiegel, Schaum's Outlines, 2021
2. Introduction to Mechanics: R. D. Kleppner and J. Kolenkow, CambridgeUniversity Press, 2nd edition, 2014
3. A textbook of Mechanics by J. C. Upadhyay,Ram Prasas Publications; 1st edition, 2017
4. Mechanics by D. S. Mathur, S. Chand; New edition, 2000
5. Theory & ProblemsofTheoretical Mechanics by M. R. Spiegel, Schaum's Outline Series, 2017

References:

1. Introduction to Special Theory of Relativity by Robert Resnick, Wiley, 1st edition 2007.
2. Concept of physics (Part-I) by H. C. Verma, Bharti Bhawan Publisher, 2022.
3. Quantum Mechanics by L.I. Schiff, McGraw-Hill Education (India) Pvt Limited, 2017.
4. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, McGraw-Hill Education (India) Pvt Limited,2010.
5. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press, 2018.

Course Code: HSS-S101 **Breakup: 3 –0 – 0 – 4**
Course Name: Communicative English

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Enhance their communication skills for tackling the professional challenges of a diverse workplace
CO2	Learn effective writing skills and be able to write clear technical reports
CO3	Improve their verbal and non-verbal communication
CO4	Be fluent orally in the use of the nuances of the English language
CO5	Learn good interpersonal skills and be proficient with the soft skills required for national and global placements

Course Details:

Unit -1 Basics of Technical Communication
Technical Communication**:** features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; Flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication.

Unit - II Constituents of Technical Written Communication
Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods - Inductive, Deductive, Spatial, Linear, Chronological etc.; The Art of Condensation- various steps.

Unit - III Forms of Technical Communication
Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes. Reports: Types; Significance; Structure, Style & Writing of Reports; Technical Proposal; Parts; Types; Writing of Proposal; Significance; Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.

Unit - IV Presentation Strategies
Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time-Dimension.

Unit - V Value- Based Text Readings
Following essays form the suggested text book with emphasis on Mechanics of writing,
The Aims of Science and the Humanities by M.E. Prior
The Language of Literature and Science by A.Huxley
Man and Nature by J.Bronowski
The Mother of the Sciences by A.J.Bahm
Science and Survival by Barry Commoner
Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
The Effect of Scientific Temper on Man by Bertrand Russell.

Text Books:

1. Meenakshi Raman & Sangeeta Sharma, Technical Communication – Principles and Practices, Oxford Univ. Press 2007, New Delhi.
2. Barun K. Mitra, Effective Technical Communication, Oxford Univ. Press, 2006, New Delhi
3. R.C. Sharma & Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill & Co. Ltd., 2002, New Delhi.

References:

1. V.N. Arora and Laxmi Chandra, Improve Your Writing ed. Oxford Univ. Press, 2013, New Delhi
2. M.Rosen Blum, How to Build Better Vocabulary, Bloomsbury Pub. London **,1989**.
3. Norman Lewis, Word Power Made Easy, W.R. Goyal Pub. & Distributors, 2008 ,Delhi.
4. Krishna Mohan, Developing Communication Skills Meera Banerji-Macmillan India Ltd. Edition: 2nd, 2009 Delhi.
5. L.U.B. Pandey & R.P. Singh, Manual of Practical Communication, A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013 ,Delhi.

Course Code: ESC-S101 **Breakup: 3 –1 – 3 – 5**
Course Name: Basic Electrical & Electronics Engineering

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Predict the behaviour of any electrical and magnetic circuits
CO2	Formulate and solve complex AC, DC circuits
CO3	Realize the requirement of transformers in transmission and distribution of electric power and other applications
CO4	Have knowledge of some basic electronic components and circuits
CO5	Understand the basics of diode and transistor circuits
CO6	Understand the working of some I C based circuits
CO7	Study logic gates and their usage in digital circuits

Course Details: (Theory)

Unit – I

Sinusoidal steady state circuit analysis, voltage, current, sinusoidal & phaser presentation single phase AC circuit – behavior of resistance, inductance & capacitance & their combination, impedance concept of power, power factor; Series & parallel resonance – band width & quality factor, three phase circuits – phase voltage & current, line & phase quantities, phasor diagram, balanced & unbalanced loads, Measurement of R, L, and C.

Unit –II

Network Theory: Network theorems – Thevenin's, Norton, maximum power transfer theorem, star delta transformation, circuit theory concept – mesh & nodal analysis.

Unit – III

Magnetic circuit concepts: self-inductance, magnetic coupling analysis of single tuned & double tuned circuit involving mutual inductance, introduction to transformer.

Unit – IV

Basic Instruments, electrical measurement – measurement of voltage, current, power & energy, voltmeters& ammeter, wattmeter, energy meter, three phase power measurement, electronics instrument–multimeter, CRO (analog & digital), An overview of voltage regulator.

Unit – V

Introduction to basic electronics devices – junction diode, BJT, amplifier, op-amps & instrumentation amplifier with mathematical operation

Number System: Introduction to binary, octal, decimal & hexadecimal systems, representation of negative, numbers, 1's, 2's, 9's, 10's complement and their arithmetic.

Text Books:

1. Edward Hughe "Electrical and Electronic Technology", 10th Edition, Pearson Education Asia, 2019.
2. P. Kothari, I J Nagrath, "Electric Machines", 5th Edition, Tata McGraw Hill, 2017.
3. P. Malvino, "Electronic Principles", 7th Edition, Tata McGraw Hill, 2007.
4. A Textbook of Electrical Technology - Volume I (Basic Electrical Engineering) 23Rev Ed Edition, S. Chand Publishing.2020

References:

1. S. K. Bhattcharya, "Basic Electrical and Electronics Engineering", Pearson, 2012.
2. Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall of India Private Limited, 2nd Edition, 2003.
3. David Bell, "Electronic Devices and Circuits", 5th Edition, Oxford University Press, 2008.
4. Michael Tooley A., "Electronic circuits: Fundamentals and Applications", 3rd Edition, Elsevier Limited, 2006.

Course Name: Basic Electrical & Electronics Engineering Lab
Course Details: (Practical)

1. Familiarization with the Electronic Instruments.
2. Familiarization with electronic components and Bread board.
3. To verify the Thevenin theorem.
4. To verify the Superposition theorem.
5. Measurement of voltage and frequency with CRO.
6. To study half wave rectifier.
7. To study full wave bridge rectifier.
8. To study full wave bridge rectifier with filter.
9. To study and verify the truth table of different logic gates using digital IC.
10. To study different type of transformer and their operation.
11. To study basic wiring and design a switchboard/extension board.
12. To study the polarity test of a single phase transformer.
13. To study the open & short circuit test of a transformer and calibration losses.
14. To study the load test and efficiency of a single phase transformer.

Course Code: MTH-S102 **Breakup: 3 –1 – 0 – 4**

Course Name: Mathematics-II

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Solve the consistent system of linear equations
CO2	Determine the power series expansion of a given function
CO3	Solve arbitrary order linear differential equations with constant coefficients
CO4	Apply Laplace transforms to solve physical problems arising in engineering
CO5	Find Eigen values, Eigen vectors & diagonalizable a matrix
CO6	Understand concept of vector space & linear transformation

Course Details:

Unit–I
Matrix Algebra: Elementary operations and their use in finding Rank, Inverse of a matrix and solution of system of linear equations. Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Normal & Unitary matrices and their elementary properties

Unit–II
Vector Space, Linear transformation, Linear dependent and linear independent, Eigen-values and Eigenvectors of a matrix, Cayley-Hamilton theorem, Diagonalization of a matrix

Unit-III
Ordinary Differential Equations of second order: Solution of linear differential equations with Constant coefficients. Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables; Method of variation of parameters, Introduction to series solution method, Frobenious Methods

Unit- IV
Ordinary differential equations of higher orders: Matrix method

Unit-V
Laplace Transform: Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals. Convolution theorem, Initial and final value theorem; Laplace transform of periodic functions, error functions, Heaviside unit step function and Dirac delta function. Applications of Laplace transform.

Text Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

References:

1. C. Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003.
2. G.F. Simmons, Differential Equations, Tata McGraw-Hill Publishing Company Ltd. 1981.

Course Code: PHY-S102 **Breakup: 3 –1 – 3 –5**
Course Name: Physics-II

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	understand the vector integration which they can apply in electricity and magnetism
CO2	Understand the concepts of wave optics such as the phenomena of interference, diffraction and polarization of light
CO3	Understand the concepts of electrostatics, magnetostatics, electromagnetic induction, Maxwell's equations and electromagnetic waves
CO4	Apply the concepts of physics in the engineering courses

Course Details: (Theory)

Unit 1
Vector integration, Stokes' theorem, divergence theorem, electrostatics: Coulomb's law, superposition of electric forces, electric flux, Gauss's law, electric field, potential, calculation of electric fields due to different charge distribution, gradient and curl of electric field, electric dipoles and multipoles, potential energy of a dipole placed in external electric field, Laplace's equation, Poisson's equation.

Unit 2
Magnetostatics, motion of charge in electric and magnetic field, Lorentz force, magnetic flux, torque on a current coil in uniform magnetic field, magnetic dipole, potential energy of a magnetic dipole, Biot-Savart law, Ampere's law, calculation of magnetic field due to different current distribution, divergence and curl of magnetic field.

Unit 3
Electromagnetic induction, Faraday's law, Lenz's law, self-induction, mutual induction, growth and decay of current in L-R circuit, electromagnetic waves, displacement current, Maxwell's equations in free space and matter, verification of Faraday's law of electromagnetic induction and Ampere's law in vacuum by using plane electromagnetic waves and derivation of velocity of light (c) in terms of permittivity and permeability of free space, Poynting vectors, Poynting theorem.

Unit 4
Coherent sources, Interference, Fresnel's biprism, interference in uniform and wedge shaped thin films, necessity of extended source, Newton's rings and its applications, Fresnel and Fraunhofer diffraction at single slit and double slits, absent spectra, diffraction grating, spectra with grating, dispersive power, resolving power of grating, Rayleigh's criterion of resolution

Unit 5
Dispersion of light, angular dispersion, dispersive power, irrational dispersion, angular and chromatic dispersion, deviation without dispersion, dispersion without deviation, polarization of light, Fresnel's theory of optical activity and polarimeter, fundamental idea of optical fiber, types of fibers.

Text Books:

1. Introduction to Electrodynamics by D.J. Griffiths, 3E, Prentice-Hall of India Private Limited, 2002.
2. Vector Analysis by M. R. Spiegel, Schaum's Outlines,2021

3. Optics by Ajoy Ghatak, McGraw Hill Education (India) Private Limited,7th Edition,2020

References:

1. A textbook of Optics by Subrahmanyam, Brijlal and Avadhanulu, Schand; 23rd Rev. Edition. 2006.
2. Classical electrodynamics by J. D. Jackson,Wiley, 3rd edition, 1998.
3. Concept of Modern Physics by Aurthur Beiser, McGraw-Hill Education,6th Edition 2021.
4. Introduction to fiber optics by Ajoy Ghatak and K. Tyagrajan, 1E, Cambridge University Press, 2012.

Course Name: Physics Lab-II

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Gain practical knowledge about electricity and magnetism and measurements such as resistance, voltage, current etc.
CO2	Gain experimental knowledge of interference, diffraction and polarization of light and measurement of the wavelengths of the monochromatic light with the help of Newton's ring experiment, Fresnel's biprism experiment, etc.
CO3	Understand the concept of semiconductor physics through the four probe experiment
CO4	Gain knowledge about the various optical devices: prism, grating, spectrometer.
CO5	Understand the basic concept of modern physics through the determination of Planck's constant

Course Details: (Practical)

1. Newton's Ring (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Traveling Microscope, Support for Glass Plate inclined at 450 to the Vertical, Short Focus Convex Lens, Sodium Lamp, Plano Convex Lens, An Optically Plane Glass Plate)

2. Prism Spectrometer (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Spectrometer, Glass Prism, Reading Lens, Mercury Lamp)

3. Plane Transmission Grating (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Spectrometer, Diffraction Grating, Mercury Lamp)

4. Ballistic Galvanometer (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Ballistic Galvanometer, Morse key, Damping key, Condenser, Rheostat, Volt Meter, Storage Battery, Connection Wires)

5. Carey Foster's Bridge (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Carey Foster's Bridge, Laclanche cell, Resistance Box, Galvanometer, Plug Key, Copper Strip)

6. Fresnel's Biprism (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Sodium Lamp, Biprism, Convex Lens, Optical Bench with Four Uprights)

7. Variation of Magnetic Field (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Stewart and Gee Type Tangent Galvanometer, Storage Battery, Commutator, Ammeter, Rheostat, One-way Plug Key, Connection Wires)

8. Polarimeter (Ref. Book by K. K. Dey, B. N. Dutta) Apparatus Used (Sodium Lamp, Polarimeter, Physical Balance)

9. Planck's Constant (Ref. Book by S.K. Gupta and UIET Laboratory Manual) Apparatus Used (Power supply, photocell, connecting wires)

10. Energy Band Gap by Four Probe Method (Ref. Book by S.K. Gupta and UIET Laboratory Manual) Apparatus Used (An experimental kit)

Course Code: ISC – S101 **Breakup: 3 –0 – 3 –5**

Course Name: Programming & Computing (C & UNIX)

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Recollect various programming constructs and to develop C programs
CO2	Understand the fundamentals of C programming
CO3	Choose the right data representation formats based on the requirements of the problem
CO4	Implement different Operations on arrays, functions, pointers, structures, unions and files

Course Details: (Theory)

- Basic concepts of Computers, Basic UNIX Concepts and Vi – Editor
- Introduction to C: Basic Programming concepts, Program structure in C, Variables and Constants, Data types, Conditional statements, control statements,
- Functions, Arrays, Structures; Introduction to pointers; Introduction to File Systems

Text Books:

1. Programming in C, Schaum Series, McGraww Hill Education, 4th Edition,2018.
2. The 'C' Programming, Denis Ritchie, 2nd Edition, Pearson Publication 1988.

References:

1. Mastering C, Venugopal, Second edition, TMH, 2006
2. Let us C, Yashant Kanetkar BPB Publication, 19th edition, 2022.
3. Programming in C, Balaguruswami, TMH Publication, 8th Edition, 2019.

Course Name: Computer Programming Lab
Course Details: (Practical)

Learning OS Commands
Practice of all Internal and External DOS Commands, writing simple batch programs, Exposure to Windows environment, Practice of UNIX commands and Vi editor, Writing simple shell script

C Programming:
Practicing programs to get exposure to basic data types, algebraic expressions, Conditional statements, Input Output Formatting, Control structures, arrays, functions, structures, pointers and basic file handling

Course Code: TCA-S102 **Breakup: 1 –1 – 6 – 5**
Course Name: Workshop Concepts

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the design and applications of different machine tools and their operations
CO2	Gain basic knowledge of casting processes and their applications
CO3	Recognize the different types metal forming process and their operations
CO4	Understand and appreciate the basic fabrication processes such as welding
CO5	Have knowledge about modern trends in manufacturing, unconventional machining processes and automation

Course Details: (Theory)

Historical perspectives and Classification of Manufacturing processes

Machining: Basic principles of lathe machine & operations performed on it. Basic description of machines & operations of shaper-planer, drilling, milling, grinding Unconventional machining processes, Machine tools.

Casting processes: Pattern & allowances, Moulding sands & its desirable properties. Mould making with the use of a core Gating system, Casting defects & remedies, Cupola furnace, Die-casting & its uses

Metal forming: Basic metal forming operations & uses of such as-forging, rolling, wire& tube drawing/making & extrusion, & its products/applications, presswork & die & punch assembly, cutting & forming, its application; Hot working vs Cold working;

Powder metallurgy: powder metallurgy process &its applications, plastic-products manufacturing, galvanizing & electroplating.

Welding: Importance & basic concepts of welding, classification of welding processes, Gas welding, types of flames, Electric arc welding. Resistance welding, Soldering & brazing and its uses,

Modern trends in manufacturing, Automation, Introduction to NC/ CNC /DNC, FMS, CAD/CAM, CIM and factory of future

Course Name: Workshop Practice

Course Details: (Practical)

1. Foundry (1turn)
2. Welding (3 turns)
   (a) Gas Welding (1turn)
   (b) Arc Welding (2 urns)
   (i) Lap Joint (1 turn) (ii) Butt Joint (1 turn)
3. M/C Shop (4 Turns)
4. Fitting & Sheet Metal Work (1 turn+1turn)
5. Carpentry Shop (1turn)
6. Black-smithy shop (1turn)

Text Books:

1. Chapman,W A J & Arnold ,E "Workshop Technology,1972 ; vol. I,II&III" Viva Low Priced Student Edition.
2. Raghuwanshi,B S "Workshop Technology ,2015; vol. I&II" DhanpatRai& Sons

References:

3. Chaudhary, Hajra “Elements of Workshop Technology, 2008; vol. I&II” Media Promoters & Publishers

Course Code: CHM – S101 **Breakup: 3 –1 – 3 – 5**

Course Name: Chemistry - I

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concept related to atoms and molecules, chemical bonding coordinate compounds and its applications
CO2	Concept of chemical kinetics, electrochemistry, photochemistry and their applications
CO3	Understand the concept of spectroscopy and its applications in various fields
CO4	Understand the basics of stereochemistry, organic reactions and its mechanism for various types of reactions
CO5	Various experiments helps the student to learn the basics of experiments to apply in day today life as well as in industry

Course Details: (Theory)

UNIT-I - Atoms and Molecules:
Need for wave mechanical picture of atomic structure [Photoelectric effect, de Broglie concept of matter waves], Derivation of Schrodinger wave equation [as an example particle moving in uni-dimensional potential well]
Chemical Bonding - Orbital concepts in bonding, V.B. and M.O. theory, M.O. diagrams, Intermolecular interactions

UNIT-II - Reaction Dynamics:
Order, Molecularity, Rate law, Integrated rate equations, Methods of determining of order of reaction, Complex reaction kinetics- chain reactions and reversible reactions in detail, Catalysis and enzyme catalysis

UNIT-III - Electrochemistry:
Arrhenius theory of electrolytic dissociation, Transport number, Kohlrausch's law, Solubility product, Redox reaction, Electrochemical and concentration cells.

UNIT-IV- Stereochemistry:
Introduction, Chirality, Enantiomers, Diastereomers, Projection formula of a tetrahedral carbon, Geometrical isomerism, Conformers

UNIT- V- Application of Spectroscopic Techniques:
Basic working principle on measurement technique: IR, UV visible spectroscopy and NMR

UNIT-VI - Organic Reactions:
Concepts Electron displacement effects, Organic intermediates, Types of reactions [addition, elimination and substitution reactions]

UNIT-VII - Photochemistry:
Principles of photo chemistry, Photoexcitation of organic molecules, Jablonski diagram, Laws of photochemistry and quantum yield, some examples of photochemical reactions, Chemistry of vision and other applications of photochemistry

UNIT-VIII - Transition Metal Chemistry:
Structure of coordination compounds corresponding to coordination number up to 6, Types of ligands, chelation, Isomerism [geometrical, optical, ionization, linkage and coordination], Theories of bonding in

coordination compounds- crystal field theory, Valence bond theory.

Text and Reference Books:

Physical Chemistry-

1 Physical Chemistry, P. Atkins and j. De Paul, 8th Edition (2006), International Student Edition, Oxford University Press.

2 Principles of Physical Chemistry B.R Pure, L. R. Sharma, and M. S. Pathania, 37th Edition (1998), Shoban Lal Nagin Chand& Co., Jalandhar.

Organic Chemistry-

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hall of India (P) Ltd, New Delhi.
2. A text book of organic chemistry, Arun Bahl & B. S. Bahl, S. Chand Publishers, New Delhi

Inorganic Chemistry-

1. Concise Inorganic Chemistry, J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. Inorganic Chemistry, j. E. Huheey, E. A. Keiter and R. L. Keiter.

Engineering Chemistry-

1. Engineering Chemistry, Shashi Chawla.
2. Engineering chemistry, P. C.Jain and Monika Jain. 16th edition,Dhanpat Rai Publishing Company **(**2015)

Course Name: Chemistry Lab- I

Course Details: (Practical)

1. To estimate the strength of the given unknown solution of Mohr's salt (Ferrous ammonium sulphate (FeSO4.(NH4)SO4.6H2O) using KMnO4 solution as an intermediate.
2. To prepare a sample of p-nitroacetanilide.
3. To prepare a sample of Aspirin.
4. Preparation of Tris (Thiourea) Copper (I) sulphate.
5. Preparation of Hexaamine Nickel (II) chloride [Ni(NH3)6] Cl2.
6. Estimation of commercial caustic soda: Determination of the amounts of sodium carbonate and sodium hydroxide present together in the given commercial caustic soda.
7. Estimation of calcium ions present in tap water.
8. To determine the partition coefficient of acetic acid between n-butanol and water.
9. To study the photochemical reduction of a ferric salt (Blue printing).
10. To determine the viscosity of a given liquid room temperature using Ostwald's viscometer.
11. To separate Ag(I), Hg (I) and Pb(II) ions by paper chromatography and calculate their RF values.
12. Understanding reaction kinetics and calculating the rate and order of a reaction.
13. To study the kinetics of first order reaction (methyl acetate hydrolysis catalysed by o.5 N HCl solution).

Course Code: MTH-S201 **Breakup: 3 –1 – 0 – 4**
Course Name: Mathematics - III

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Obtain the Fourier series expansion of a given function
CO2	Apply Fourier transform for solving Boundary Value Problems
CO3	Determine the solution of linear partial differential equations (PDE) by variable Lagrange's method & some nonlinear PDEs
CO4	Understand and use of complex variable & analyticity
CO5	Expand a function of Laurent series
CO6	Evaluation of real integrals using residues

Course Details:

Unit – I
Function of a Complex variable: Complex numbers- power and roots, limits, continuity and derivative of functions of complex variable, Analytic functions, Cauchy - Reimann equations, Harmonic function, Harmonic conjugate of analytic function and methods of finding it, Complex Exponential, Trigonometric, Hyperbolic and Logarithm function.

Unit – II
Complex Integration: Line integral in complex plane (definite and indefinite), Cauchy's Integral theorem, Cauchy's Integral formula, Derivatives of analytic functions, Cauchy's Inequality, Liouville's theorem, Morera's theorem, Power series representation of analytic function and radius of convergence, Taylor's and Laurent's series, singularities, Residue theorem, Evaluation of real integrals, Improper Integrals of rational functions.

Unit-III
Fourier series: Trigonometric Fourier series and its convergence. Fourier series of even and odd functions, Fourier half-range series; Parseval`s identity, Complex form of Fourier series;

Unit-IV
Fourier Transforms: Fourier integrals, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transforms and their elementary properties, Convolution theorem, Application of Fourier transforms to BVP

Unit-V
Partial Differential Equations: Formation of first and second order partial differential equations. Solution of first order partial differential equations: Lagrange`s equation, Four standard forms of non-linear first order equations.

Text and Reference Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

Course Code: ESC-S201 **Breakup: 3 –1 – 0 – 4**
Course Name: Engineering Mechanics

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the fundamentals of engineering mechanics and their applications
CO2	Gain knowledge of various types of motion related to body
CO3	Understand the basic concepts of friction and application of friction
CO4	Identify appropriate structural system for studying a given problem and isolate it from its environment
CO5	Carry out kinematic and kinetic analyses for particles and systems of particles
CO6	Apply the principles of mechanics to practical engineering problems

Course Details:

General Coplanar force systems: Basic concepts, Law of motions, principle of transmissibility of forces, transfer of a force to parallel position, Resultant of a force system, simplest resultant of two dimensional concurrent & non-concurrent force systems, free body diagrams, equilibrium & its equations, applications

Trusses & Cables: Introductions, simple truss & solutions of simple truss, method of joints & method of sections.

Friction: Introduction, Laws of coulomb friction, equilibrium of bodies involving dry friction, belt friction, applications.

Centre of gravity, centroid, Moment of Inertia: Centroid of plane, curve, area, volume & composite bodies, moment of inertia of plane area, parallel axis theorem, perpendicular axis theorem, principal moment inertia, mass moment of inertia of circulating, disc, cylinder, sphere and cone about their axis of symmetry.

Beams: Introductions, shear force and bending moment, differential equations for equilibrium, shear force & bending moments diagrams for statically determinate beams.

Kinematics of rigid body: Introduction, plane motion of rigid bodies, velocity & acceleration under translation & rotational motion, Relative velocity, projectile motion.

Kinetics of rigid bodies: Introduction, force, mass & acceleration, work & energy, impulse & momentum, D'Alembert principles & dynamic equilibrium, Virtual work.

Text Book :

1. Beer F.P. &Johnston ,F.R. " Mechanics For Engineers" 11th edition 2017, McGraw Hill.

References:

1. Shames, I.H. " Engg. Mechanics" 4thedition2005 , PHI.
2. Meriam , J. L. " Statics" 7th edition 2011, J. Wiley.

Course Code: ESC-S202 **Breakup: 3 – 1 – 0 – 4 Course**

Name: Thermodynamics

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Use thermodynamic terminology correctly and explain fundamental thermodynamic properties
CO2	Derive and discuss the zeroth, first, second, and third laws of thermodynamics
CO3	Apply the first and second laws of thermodynamics to chemical processes and calculate efficiency
CO4	Solve problems using the properties and relationships of thermodynamic fluids.
CO5	Analyse the behaviour of flow and non-flow processes using mass and energy balances
CO6	Analyse basic thermodynamic cycles

Course Details:

Fundamental concepts: System, Property, Work and Heat interactions.

Zeroth law: Zeroth law of thermodynamics, Temperature & its measurement & scales.

First law: Thermodynamic processes, calculation of work in various processes, non-flow work & flow work. Joule's experiment, first law of thermodynamics applied to open systems, study flow system and their analysis. Applications to closed systems and flow processes. Analysis of unsteady processes. Limitations of first law of thermodynamics, PMM 1. Thermodynamics properties of fluids.

Second law: Devices converting heat to work, Thermal reservoir, heat engines efficiency, Devices converting work to heat, heat pump, refrigerator, COP, Reversed heat engine, Kelvin Planck statements, Clausius statement, reversible& irreversible processes, Carnot cycle, PMM2, Entropy, Availability, equilibrium Criterion, Maxwell Relations Thermodynamics relations, Clapeyron equation, Gibb's Phaserule.

Properties of steam & thermodynamic cycles: pure substance, properties of steam, Phase Diagram, Power& Refrigeration cycles, Psychometric. Adiabatic flame temperature, Equilibrium conversion, Statistical definition of entropy Kinetic theory of Ideal Gases.

TextBooks:

1. Y.A.CengelandM.A.Boles,Thermodynamics-AnEngineeringApproach,McGrawHill,2019
2. Y.V.C.Rao,IntroductiontoThermodynamics,UniversitiesPress, 2003
3. P.K. Nag "EngineeringThermodynamics".TataMcGrawHill,2005

References:

1. D.B. Spalding&E.H. Cole "Engg.Thermodynamics". EdwardArnold, 1923.
2. G. Hawkins,"Engg.Thermodynamics"JohnWiley&Sons,2005.
3. G.H. VanWylen, &R.E.Sonntag,"FundamentalsofClassicalThermodynamics".JohnWiley&Sons,1965
4. J.P. Hollman, "Thermodynamics".McGrawHill, 1988

Course Code: HSS-S301 **Breakup: 1 –0 – 1 – 2**
Course Name: Professional Communication

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the nuances of English language for enhancing presentation skills
CO2	Speak in standard English with clarity and fluency and to write business messages professionally
CO3	Speak and communicate clearly in different professional contexts which would improve their chances of employability
CO4	Understand the importance of ethical practices in their professional life

Course Details:

Unit 1- Presentation techniques
Meaning and importance of presentation technique
Presentation skills required for business organization: Negotiation, Persuasion & Time management
Types of business presentations- meetings, seminars, conferences

Unit 2- Oral presentations
Effective oral delivery- Phonetics
Interviews, Group discussions, debates, speeches
Listening skills, Reading skills

Unit 3- Written communication
Style and tone of writing business messages and documents
Persuasive, sales and goodwill messages, delivering bad news
Writing e-mails and short messages, Resume writing

Unit 4 – Non Verbal communication
Nonverbal communication techniques
Business manners, ethics and personality development
Power point presentations

Text Book:

1. "Business Communication Today", Bove`e, Thill and Schatzman: Pearson Education (Singapore), 2003.

References:

1. "Business Communication-a framework of success", H. Dan O'Hair, James S. O'Rourke and Mary John O'Hair: South Western College Publishing, 2001.
2. "Basic Business Communication", Raymond V. Lesikar, Marie E. Flatley: Tata McGraw Hill Publishing Company Ltd., 2002.

Course Code: SSM-S301 **Breakup: 0 –0 – 2 – 2**
Course Name: Student Seminar

Course Details:

Each student is required to present a seminar of 20-30 minutes on a topic related to current research in Electronics & Communication Engineering.

Course Code: SST-S401 **Breakup: 0 –0 – 0 – 2**
Course Name: Summer Training

Course Details:

A written report and an oral presentation/ interview during the (following) semester after successful completion of an 8-week industrial in-plant training with a Electronics industry taken during the summer break.

Course Code: PRT-S401 **Breakup: 0 –0 – 6 – 4**
Course Name: Project-I
Course Details:

Equipment/Circuit design to be done by groups of students

Course Code: EVS-S101 **Breakup: 2 –0 – 0 – 2**
Course Name: Environmental Science

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concepts and definitions associated with ecosystems, environmental pollution and its causes
CO2	Gain knowledge to analyse problems and suggest alternatives and new methods to manage natural resources
CO3	Understand how to Redesign, Recreate & Restore the ecosystems
CO4	Understand the legal aspects and the role of government in environment protection

Course Details:

UNIT-I
Scope and Importance of environmental studies, Need for public awareness, Segments of environment, biodiversities: Genetic diversity, Species diversity, Ecosystem diversity, Landscape diversity, Causes of pollution and detrimental effects.

UNIT-II
Eco systems- Types of systems, energy flow in an ecosystem, Balanced ecosystem,
Human activities- Food, shelter, economic and social security, Effects of human activities on environment- Agriculture, housing, Industry, mining and transportation activities, Basics of Environmental Impact Assessment, Sustainable Development.

UNIT-III
Types of natural resources: Water resources-Availability and quality aspects, Water borne diseases, Fluoride problems in portable water, Mineral resources, Food resources, Land resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur cycle.

UNIT-IV
Energy- Different types of energy (Renewable and Non-renewable), Convectional and non- conventional energy-sources Electromagnetic radiation, Hydro Electric, Fossil fuel based, Nuclear, Solar, Biomass and Bio-gas, Hydrogen as an alternative future source of energy

UNIT-V
Environmental pollution and their effects, Water pollution, Land pollution, Noise pollution, public Health aspects, Air pollution. Current environmental issues of importance and their impact on environment: Population Growth, Climate change and global warming effect, Urbanization, Automobile pollution, Acid rain, Ozone layer depletion.

UNIT-VI
Preventive measures and control of pollution, Air and Water pollution control, Sold waste management, Case studies.

UNIT-VII
Role of Government in environment protection, Legal Aspects, Initiatives and protection Acts, public awareness, Initiatives by Non-governmental Organizations (NGOs), Role of IT services, Disaster management.

UNIT-VIII
Field work/ Activities/ Visit
Text and References Books:

1. Environmental Studies- Benny Joseph, TATA Mcgaw Hill publication, Third edition, 2017.
2. Environmental Studies- Dr. D.L. Manjunath, pearson Education, 2022.
3. Environmental Studies- R. Rajgopalan, Oxford publication.

4. Environmental Science and Technology- M. Anji Reddy, BS publication.
5. Principles of Environmental Science and Engineering- P. Venugopalan Rao, Prentice Hall of India, 2006.
6. Environmental Science and Engineering- Meenakshi, Prentice Hall of India, 2005.

Course Code: HSS-S201 **Breakup: 3 –0 – 0 – 3**
Course Name: Industrial Management

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the concepts related to business and demonstrate the roles, skills and functions of management
CO2	Understand how the industrial company can be organized and managed
CO3	Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities
CO4	Express leadership and entrepreneurial attributes through various case studies

Course Details:

UNIT-1
Introduction, Nature and Scope, Evolution of Management, Approaches to Management: Scientific, System and Contingency.

UNIT-2
Taylor's Scientific Management, Fayol's Administrative Management, Contribution of Mayo, Drucker etc., Levels and skills of management

UNIT-3
Organization: Types and structure, Formal-Informal, Line and Staff relationship, Centralization - Decentralization

UNIT-4
Functions of Management Planning: Organization, Staffing, Directing, Controlling, Decision-Making, Management by objectives, Leadership.

UNIT-5
Psychological foundation of Management: Motivation, Personality, Group dynamics, Models of Herzberg, Maslow etc.

UNIT-6
Plant layout, Plant location, Planning and Control, Materials, Management, Inventory control

Text Books:

1. O.P.Khanna, Industrial Engineering, **1** January 2018
2. T. R. Banga Industrial Engineering and Management, 2008

Reference:

1. Mahajan: Industrial and Process Management, 1 January 2015.

Course Code: HSS-S401 **Breakup: 3 –0 – 0 – 3**

Course Name: Engineering Economics

CO1	Understand the concepts related to business and demonstrate the roles, skills and functions of economics
CO2	Understand how the industrial company economics can be organized and managed
CO3	Understand the complexities associated with economic management of human resources in the organizations and integrate the learning in handling these complexities

UNIT-1

Meaning, definition and scope of economics, Basic concepts of demand and supply, Market equilibrium, Ceiling price and floor price

UNIT-2

Price elasticity of demand: Factors affecting price elasticity of demand, Relation between marginal revenue and price elasticity, Income elasticity of demand and Cross elasticity of demand, Indifference curves, Budget Line

UNIT-3

Production and Cost analysis: Basic concepts, Production in the short- run and long-run, cost analysis Finding the

optimal combination of inputs, Returns to scale.

UNIT-4

- Market: Characteristics of perfect completion, Profit maximisation in short-run and long-run
- Firms with market power: Measurement and determinants of market power, Profit maximisation under monopoly: output and pricing decisions, Price discrimination, capturing consumer surplus, Strategic decision making in oligopoly markets

UNIT-5

- National income: Concepts, Sources, Measurement, Difficulties, circular flow of income
- Inflation: Cost-push and Demand-pull inflation, Effects and control of inflation, Business cycle, Functions of RBI, GST

Texts and Reference Books:

1. Economics by Paul. A. Samuelson, 2015.
2. Managerial Economics by Christopher R. Thomas, S. Charles Maurice, Sumit Sarkar, 2012.
3. Financial Management by J. V. Vaishampayan, 2017
4. Microeconomics by A. Koutsoyannis, 2009

Course Code: UHV-S201 **Breakup: 2 –1 – 0 – 3**
Course Name: Universal Human Values - II

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc
CO3	Understand the role of a human being in ensuring harmony in society and nature
CO4	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work

Course Details:

UNIT I:
- Introduction to Value Education
- Value Education, Definition, Concept and Need for Value Education.
- The Content and Process of Value Education
- Basic Guidelines for Value Education
- Self-exploration as a means of Value Education
- Happiness and Prosperity as parts of Value Education

UNIT II:
- Harmony in the Human Being
- Human Being is more than just the Body
- Harmony of the Self ('I') with the Body
- Understanding Myself as Co-existence of the Self and the Body
- Understanding Needs of the Self and the needs of the Body
- Understanding the activities in the Self and the activities in the Body

UNIT III:
- Harmony in the Family and Society and Harmony in the Nature
- Family as a basic unit of Human Interaction and Values in Relationships
- The Basics for Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude and Love
- Comprehensive Human Goal: The Five Dimensions of Human Endeavour.
- Harmony in Nature: The Four Orders in Nature.
- The Holistic Perception of Harmony in Existence

UNIT IV:
- Social Ethics
- The Basics for Ethical Human Conduct
- Defects in Ethical Human Conduct
- Holistic Alternative and Universal Order
- Universal Human Order and Ethical Conduct
- Human Rights violation and Social Disparities

UNIT V:
- Professional Ethics
- Value based Life and Profession.

- Professional Ethics and Right Understanding
- Competence in Professional Ethics
- Issues in Professional Ethics – The Current Scenario
- Vision for Holistic Technologies, Production System and Management Models

Text and Reference Books:

1. R.R. Gaur., R, Sangal. G.P Bagaria., A Foundation Course in Value Education, Excel Books, (2009).
2. R.R. Gaur., R, Sangal. G.P Bagaria, Teachers Manual for A Foundation Course in Human Values and Professional Ethics Excel Books, (2009).
3. A.N. Tripathy, Human Values, New Age International Publishers, (2003)
4. Nagaraj, JeevanVidya: EkParichaya, JeevanVidyaPrakashan, Amarkantak, (1999)
5. M.K. Gandhi, My Experiemnts with Truth, Maple Classics (2011)
6. I.C. Sharma, Ethical Philosophy of India, Nagin & Co Julundhar
7. Cecile Andrews, – Slow is Beautiful (2006)

Course Code: PRT-402 **Breakup: 0 –0 – 6 – 4**
Course Name: Project-II

Course Details:

Simulation/Experimental/Research/Design Projects to be done by groups of students.

Course Code: ECE – S201T **Breakup: 3 1 0 3**

Course Name: Analog Electronics

Course Outcome:

CO1	Describe the properties of materials and Application of semiconductor electronics
CO2	Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO3	Classify and describe the semiconductor devices for special applications
CO4	Understand major properties of semiconductor materials, explain energy band diagrams and connections with the device structures and properties;
CO5	Understand and utilize the basic governing equations to analyse semiconductor devices; design semiconductor devices and calculate device characteristics;
CO6	Quantitatively evaluate limitations in the design of circuits based on specific semiconductor devices;
CO7	Understand and outline major steps of semiconductor device fabrication.

Course Details:

Unit-I

Energy bands in solid, Concept of forbidden gap, Insulator, Metals and Semiconductor. Transport phenomenon in semiconductors: - mobility and conductivity, intrinsic semiconductor, donor and acceptor impurities, Fermi level, Drift currents and Diffusion currents.

Unit-II

Review of Junction, Diode Applications: Half wave and Full Wave Rectifier, bridge Rectifier, Capacitor Filter, Diode clipping, Clamping and voltage multiplying circuits.
Special diode Types: Zener diode, Schottky barrier diode, Varactor diode, Photodiode, Light emitting diode.

Unit-III

Review of Bipolar junction transistor and its configuration. Requirement of biasing, Self-biasing in CE configuration, Bias stability.
Transistor as amplifier: Small signal equivalent circuit, The Hybrid-pi model, The T-model, augmenting these models for the Early effect, Graphical analysis of CE amplifier, Voltage gain, current gain and input- output impedance calculation, Approximate equivalent circuit in CE, CB and CC configurations. A general large signal model for BJT- The Ebers-Moll Model.

Unit-IV

Field effect transistor: Structure and physical operation of Enhancement type MOSFET. The Depletion Type MOSFET, MOSFET circuits at DC, The MOSFET as an Amplifier. Biasing in MOS Amplifier circuits, Basic configuration of single stage IC MOS amplifier. C-S Amplifier, C-G Amplifier, C-D Amplifier (source follower) configurations.

Unit-V

The Junction Field Effect Transistor, Gallium Arsenide Devices, the MESFET Device Structure, Operation, Characteristics and Models.

Textbooks:

1. Boylstad & Neshishkey, "Electronic devices & circuits" , PHI, 10th Edition 2008.
2. Milliman, J. Halkias, "integrated elctronics",TMH**,** 1 July 2017

References:

1. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices" / Prentice Hall (India) / 5thEd / Pearson Education 2014 .
2. Bell, David A. / "Electronic Devices & Circuits"/ Prentice-Hall (India), 5thEd. 2004.
3. Millman, J. and Grabel, A. / "Microelectronics"/ McGraw–Hill 2nd edition ,1988.
4. Nair, B. Somanathan /"Electronic Devices & Applications"/ Prentice-Hall(India) 1st edition 2006
5. Nagrath , I.J. / "Electronics, Analog & Digital"/ Prentice-Hall(India) 2nd edition ,2014.
6. Neamen, Donald A. / "Electronic circuit Analysis & design" / Tata McGrawHill, 2003.
7. Salivahanan, S. & Kumar, Suresh N. & Vallavraj / "Electronic Devices & Circuits" / TataMcGraw-Hill 2nd edition 2007.

Course Code: ECE – S201P **Breakup: 0 0 2 2**

Course Name: Analog Electronics Lab

Course Outcome:

CO1	Describe the properties of materials and Application of semiconductor electronics
CO2	Apply the knowledge of semiconductors to illustrate the functioning of basic electronic devices.
CO3	Classify and describe the semiconductor devices for special applications
CO4	Understand major properties of semiconductor materials, explain energy band diagrams and connections with the device structures and properties;
CO5	Understand and utilize the basic governing equations to analyze semiconductor devices; design semiconductor devices and calculate device characteristics;
CO6	Quantitatively evaluate limitations in the design of circuits based on specific semiconductor devices;
CO7	Understand and outline major steps of semiconductor device fabrication.

Course Details:

List of Experiments:

1) To measure DC/AC voltage and frequency using CRO and FG.
2) To obtain the static characteristics of a PN junction diode and then obtain the forward resistance of the diode at a given operating point.
3) To obtain V-I characteristics of a Zener diode and note down its breakdown potential.
4) Fabrication and testing of a half wave rectifier and observe the smoothing of the output using capacitor filter and ripple suppression using a zener diode.
5) To bias a given transistor in active region in CE configuration.
6) Measurement of current gain A_i, Input impedance R_I, and output impedance R_o,for an RC coupled CE amplifier in mid frequency range(e.g. 1 KHz).
7) CE amplifier and make the
   (i) Upper cut off.
   (ii) Lower cutoff frequencies and hence estimate the BW.
8) Bias a MOS transistor in saturation region in C-S configuration.
9) Bias a JFET in saturation region and operates it as an RC coupled amplifier in C-S configuration and measure the voltage gain.

Course Code: ECE – S202 Breakup: 3 1 0 4

Course Name: Network Analysis and Synthesis

Course Outcome:

CO1	Understand the concept of graph theory using different analysis methods
CO2	Apply different network functions for the analysis of electrical networks
CO3	Understand the concept of two port networks
CO4	Understand the properties of network functions
CO5	Explain about the fundamental and types of filter

Course Details:

Unit-I

Introduction to graph theory: Definitions- graph, tree, spanning tree, loop, co-tree, cut set, tie set, loop and nodal analysis, introduction to continuous time signal, unit step, ramp, and impulse.

Unit-II

Network Transient and steady state analysis, Transient response of simple RL, RC, series and parallel circuits, Transient response of RLC series and parallel circuits for sinusoidal and step input excitation using Laplace transform method. Differential equation formation of linear time invariant continuous systems, block diagram representation of LTI continuous networks and systems, time domain analysis of LTI network using Laplace transform. Relation between impulse response and system functions, concepts of transform impedance and synthesis.

Unit-III

Network Functions: Concept of Complex Frequency, Transform Impedances, Network function of one port and two port networks, Concept of poles and zeros, Relation between locations of poles. Time response and stability. Frequency response and bode plots. Interrelation between frequency response and convolution integral.

Unit-IV

Two port networks, Two port parameters, Inter-conversion of 2 port parameter, network function-Driving point and transfer function, Inter-connections of 2 port networks, reciprocity ladder networks, Image impedance, Characteristic impedance, $T - \pi$ transformation and analysis.

Unit-V

Positive real functions and properties, synthesis of LC, RL and RC using Cauer and Fosters first and second form.

Text books:

1. M.E.Valkenburg:NetworkAnalysis, Peaerson 3/ED. January 1, 1974 .
2. D.R.Choudhary:NetworkAnalysis, Pearson 1988.

References:

3. Narsingh Deo : "Graphtheory" Prentice Hall, 1974
4. A.Chakrabarti,"Circuit Theory" Dhanpat Rai &Co., 2013
5. W.H.Hayt &JackE-Kemmerly,EngineeringCircuitanalysis"TataMcGraw-Hill **, 2011**
6. Soni, Gupta ,"Circuit Analysis", Dhanpat Rai &Sons ,1979
7. Ram Kalyan, Linear Circuits Oxford UniversityPress 2005.

Course Code: ECE – S203T **Breakup: 3 0 0 3**

Course Name: Digital Electronics

Course Outcome:

CO1	To examine the structure of number systems and perform the conversion among different number systems.
CO2	To understand the Digital Logic Family.
CO3	Illustrate reduction of logical expressions using Boolean algebra, k- map and implement the functions using logic gates. Realize combinational circuits for given application.
CO4	Design and analyses synchronous and asynchronous sequential circuits using flip-flops.
CO5	To analyse different types of multivibrators
CO6	To study static and dynamic RAMs, ROM, EPROM, and EEPROM.
CO7	Implement combinational logic circuits using programmable logic devices.

Course Details:

Unit – I

Logic circuits & Boolean algebra: Number systems, conversion from one number system to another number system, Gray code,Excess-3 code, BCD Code, Boolean algebra – Boolean theorems, minimization of Boolean functions, K-Map, Basic logic gates, Universal gates, Boolean functions realization using logic gates, Logic families-Diode switching, transistor as a switching elements, Circuit concepts & comparison of logic families-RTL,DTL,TTL,ECL,NMOS & COMS, Tristate Logic open collector outputs, Logic gate characteristics.

Unit – II

Combinational circuits- Design of Binary adder, Subtractor, Parallel binary adder subtractor Circuit, BCD adder, decoders, multiplexer, de-multiplexers & their applications, Digital Comparators, Code convertors, BCD to Seven segments decoder.

Unit-III

Sequential circuits: introduction to sequential logic, Flip-Flops-RS Flip-Flop, D Flip-Flop, T Flip- Flop, JK flip-flop, Excitation and characteristics table of Flip-Flops, characteristics equation, Conversion of one form of Flip-Flops to another type, race around condition, Master slaves, flip-flop clocked sequential circuits.

Unit – IV

Counter and shift register: Design of Asynchronous & Synchronous counters & circuits, Ripple counter and Up-down Counters, Ring counter, Counter with unused states, shift registers, Serial & parallel data transfer, Shift left/right register,

Unit – V

Multivibrators & Memories: Monostable multivibrator, Bistable Multivibrator, Astable multivibrator Schmitt trigger circuit, Memory organization and operation, Write operation, read operation, Types of memory-RAM, ROM,PROM,EPROM,EEPROM, Digital techniques related to PLAs, PALs, ROMs, PLDs, Introduction to BiCMOS circuits.

Text books:

1. Digital Design, Morris Mano, PHI, 2008.
2. Digital Electronics, Bignill & Donovan, Delmar publishers, 1989

References:

1. Taub and Schilling “Digital Integrated Electronics”,TMH, 1977**.**
2. Bartee , Thomas C. / “Fundamentals of Digital Computers”/ TataMcGraw-Hill, 1979.
3. Gopalan, K. “Gopal” / “Introduction To Digital Microelectronic Circuits” / TataMcGraw-Hill, 2002
4. Millman, Jocob & Taub, Herbert / “Pulse, Digital & Switching Waveforms” / TataMcGraw-Hill 1991Edition: 1st.
5. Malvino, A.P. & Leach, Donald P. / “Digital Principles & Applications” / TataMcGraw-Hill, 7th Ed.,2011
6. Digital Electronics Principles & Application, Tokheim, H. Roger L., Tata McGraw-Hill ,8th Ed., 2014

Course Code: ECE – S203P **Breakup: 0 0 3 2**

Course Name: Digital Electronics Lab

Course Outcome:

CO1	To examine the structure of number systems and perform the conversion among different number systems.
CO2	To understand the Digital Logic Family.
CO3	Illustrate reduction of logical expressions using Boolean algebra, k- map and implement the functions using logic gates. Realize combinational circuits for given application.
CO4	Design and analyses synchronous and asynchronous sequential circuits using flip-flops.
CO5	To analyse different types of multivibrators
CO6	To study static and dynamic RAMs, ROM, EPROM, and EEPROM.
CO7	Implement combinational logic circuits using programmable logic devices.

Course Details:

List of Experiments:

1. To study the operation of transistor

   (a) As a normal open switch(inverter).

   (b) As a normally closed switch.

2. To realize two input AND, OR, NAND, NOR gate using diodes and transistor inverter and verify truth table.
3. To verify NAND gate operation on IC-7400, NOR gate operation on 7402 and realize AND, OR, EX- OR, NOR gates using NAND gates.
4) (a)To realize the circuit of half Adder and Full adder and verify the truth table using 7400 NAND gates only.
   (b)Verify the operation of 7483four bit adder.
5) To verify the truth table of 4 X 1 multiplexer using IC-74153.
6. (a) To realize 2 to 4-line decoder with and without enables and verify their truth tables.
   (b) To realize a 4 X 2 encoder and verify its truth table.
7. To realize a 3 variable Boolean function using multiplexer IC 74153.
8. To study the various types of Flip-Flops

   (a) RS Latch

   (b) Clocked RS Flip-Flop

   (c) D Flip-Flop

   (d) Verify the operation of JK flip-flop using IC 7476
9. To verify the operation of 7490-decade counter as

   a) MOD2 Counter.

   b) MOD5 Counter

c) MOD 10 counter.

10. Display the count on a seven-segment display.
11. To realize and verify the operation of 4-bit shift input resister-using IC 7474

Course Code: ECE – S204T **Breakup: 3 0 0 3**

Course Name: Electrical Machine

Course Outcome:

CO1	Understand the working principles of Transformer and Induction Motor.
CO2	Calculate the Performance of both transformer and induction motor.
CO3	Identify different speed controlling techniques of Induction motor for the given application.
CO4	Identify suitable transformer depending on the application of transmission and distribution.
CO5	Calculate the load sharing of different transformers in the power engineering.

Course Details:

Unit – I

D.C. Machines: Constructional features and principles of operation of shunt, series and compound generators and motors including EMF equation and armature reaction, performance characteristics of generators and motors, starting speed control and breaking of motors.

Unit – II

Two quadrant and four quadrant operation of motors choice of de motors for different application. Losses and efficiency. Transformers: construction EMF equation, principle of operation. phasor diagram on no – load. Effect of load equivalent circuit, voltage regulation. losses and efficiency.

Unit – III

Tests on transformers. Prediction of efficiency and regulation, autotransformers, Instrument transformers, three phase transformers. Induction motors: rotating magnetic fields. principles of operation.

Unit – IV

Equivalent circuit, torque – slip characteristic. Starters for cage and wound rotor type induction motors, speed control and breaking, single phase induction motors and methods of starting.

Unit – V

Synchronous machines: Construction, EMF equation. Effect of pitch and distribution, armature reaction and determination of regulation of synchronous generators. principle of motor operation, effect of excitation on line currents (V – curves). Methods of synchronization. Typical applications of AC motor in industries.

Textbooks:

1. Hughes Edward, Electrical Technology, Addison Wesle longinanltd, 2001.
2. Nagrath I.J.& Kothari D.P.Electrical Machines.TMH, Delhi, 2004.

References:

1. Cotton H., Advanced Electrical Teclitiolog , Wheeler &Co., **1 January 2011**
2. Fitzerald, Kingsicy, Kusko – Dunias – Electrical Machines.TMLA. **January 1, 1990**
3. Kosow L.L, Electrical Machines and Transformers.PHI, 2007

Course Code: **ECE – S204P** **Breakup:** **0 0 3 2**

Course Name: **Electrical Machine Lab**

Course Outcome:

CO1	Understand the working principles of Transformer and Induction Motor.
CO2	Calculate the Performance of both transformer and induction motor.
CO3	Identify different speed controlling techniques of Induction motor for the given application.
CO4	Identify suitable transformer depending on the application of transmission and distribution.
CO5	Calculate the load sharing of different transformers in the power engineering.

Course Details:

List of Experiments:

1) Study of different type of transformer and specification.
2) To wind 5-0-5 or 12-0-12 single phase transformer.
3) Determination of circuit parameters and loss in single phase transformer by OC test.
4) Determination of circuit parameters in single phase transformer by SC test.
5) Measurement of efficiency of transformer.
6) Calculation of voltage regulation of single phase transformer,
7) Speed control of dc shunt motor by field control method.
8) Speed control of dc shunt motor by armature control method.
9) To study the construction and principle of operating of single phase induction type energy meter
10) To find the calibration error of single phase induction type energy meter.
11) To study the three phase induction motor and determination of efficiency.
12) To study synchronous meter.

Course Code: ECE – S205 **Breakup: 3 1 0 4**

Course Name: Electromagnetic Theory

Course Outcomes:

CO1	To differentiate different types of coordinate systems and use them for solving the problems of electromagnetic field theory.
CO2	To describe static electric and magnetic fields, their behaviour in different media, associated laws, boundary conditions and electromagnetic potentials.
CO3	To use integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.
CO4	To describe time varying fields, propagation of electromagnetic waves in different media, pyonting theorem, their sources & effects and to apply the theory of electromagnetic waves in practical problems.
CO5	To apply concepts of Wave reflection and refraction, Smith Chart in practical Field.

Course Details:

Unit-I

Electrostatics and Magneto-statics

Review of vector calculus, Coulomb's law, Electric displacement and Displacement density, Lines of Force and Lines of Flux. Gauss's law, the potential function, Field of infinitesimal Electric dipole, Field due to continuous distribution of charges, equipotential surfaces, Divergence Theorem, Poisson's Equation and Laplace's equation, Solution by means of Electrical images, Capacitance, Capacitance of parallel plate and coaxial cables, Energy in Electrostatic fields, Boundary conditions.

Steady Magnetic Field: Magnetic field strength H, Magnetic flux density B, MMF, Ampere's circuital law, Ampere's work law in differential vector form, Permeability, Energy stored in a Magnetic field, Ampere's law for a current element (Biot-Savart Law), Magnetic vector potential, Boundary conditions, Analogies between Electric and Magnetic fields.

Unit-II

Time Varying Fields and Maxwell's Equation

The Equation of continuity for Time-Varying Fields, Maxwell's Equations, Representation in Differential form, Integral form and word statement, Boundary conditions, Faraday's law of electromagnetic induction, Transformer and motional EMF, Time harmonic field, Electromagnetic potential, Relation between circuit theory and field theory.

Unit-III

Uniform Plane Wave

Wave equation: solution for Dielectric and Conducting media, free space propagation, Surface impedance, Depth of penetration (skin depth), phase velocity, and group Velocity, Polarization of uniform plane waves, Reflection by a Perfect conductor, normal and oblique incidence, Reflection by a

perfect Dielectric-Normal and Oblique Incidence, Brewster Angle, Surface Impedance.

Poynting Vector and Flow of Power: Poynting theorem, Instantaneous average and Complex Poynting Vector, Power Loss in a Plane Conductor.

Unit-IV

Transmission Line and Guided Waves

Distributed parameters Model of Transmission Line, open wire and coaxial cable, Transmission line theory: line equation, lossless line, Voltage standing wave ratio (VSWR), Transmission line as circuit element, Quarter wave transformer, Impedance matching, single stub, Solution of Transmission Line problems using Smith chart.

Wave between parallel planes, TE waves, TM waves, characteristics of TE and TM waves, TEM waves and its properties, Attenuation in parallel plane guides, wave impedance.

Unit-V

Introduction to Radiation

Vector potential **Radiation from small current element:** Near Field and Far Field, Radiation Pattern, Power Radiated, Radiation Resistance.

Text Books:

1. Engineering Electromagnetic- Hayt (sixthedition), 1984.
2. Electromagnetic- Wave and radiating System-Jorden &Balmein, 1968
3. Electromagnetic- J.F.D. Kraus; Antenna-J.F.D.Kraus, 2005.
4. Electromagnetic- Kraus &Keith; Antenna, and wave Propagation –K.D.Prasad, **2012**

References:

1. Harington, R. F. / "Time Harmonic EM Fields" / McGrawHills, 1961
2. Collin, R. E. / "Antennas and Radio Wave Propagation"/ TataMcGraw-Hill, 1985.
3. Pramanik,Ashutosh/"Electromagnetism,Theory&Applications"/PrenticeHall India **,2014**.
4. Schaum's Outlines / "Electromagnetics" / Tata McGraw-Hill / 2nd Ed, *1994* .
5. Kraus,Fleisch/"ElectromagneticswithApplications"/TataMcGraw-Hill,2010..
6. Sadiku,MatthewN.O./"ElementsofElectromagnetics"/OxfordUniversityPress,2007.

Course Code: **ECE – S301** **Breakup: 3 1 0 4**

Course Name: **Electronic Circuit**

Course Outcome:

CO1	To explain the theoretical principles essential for understanding the operation of electronic circuits,
CO2	Measure the characteristics of electronic circuits and present experimental results
CO3	Analyze electrical circuits and calculate the main parameters,
CO4	Develop, design and create simple analogue and digital electronic circuits,
CO5	Choose an engineering approach to solving problems, starting from the acquired knowledge essential for the design of electronic circuits

Course Details:

Unit –I

Multistage Amplifiers – Effect of coupling and bypass capacitors. Low frequency response of the Common Source and Common Emitter Amplifiers. The Hybrid-pi Model of BJT, The MOSFET internal Capacitance, High frequency response of CS and CE Amplifiers, The Common Base, Common Gate and Cascode Configurations, Frequency Response of Emitter and Source Followers.

Unit-II

Feedback amplifiers and oscillators: Principles of feedback in amplifiers advantages of negative feedback. Classification of feedback, voltage series, and voltage shunt, current series. Current – shunt effect of feedback on input and output impedance. Gain, stability, noise, distortion and band width Barkhausen criterion for sinusoidal oscillators. Phase shift oscillator. Wein-bridge oscillator, Hartley oscillator, Colpitts oscillator, crystal oscillator, frequency stability.

Unit – III

D.C. Amplifier: Problems in DC amplifier, chopper amplifier, differential and common mode gain, CMRR, cascade and Darlington pair amplifier.

Unit-IV

Output stages and Power Amplifiers: Classification of Output stages A/B/AB, single-ended and Push-Pull Configuration, Power dissipation and Output Power conversion efficiencies, complimentary-symmetry Power Amplifier.
Power BJTs- Junction Temperature, Thermal resistance, Transistor case and Heat sink.
MOS Power Transistors: Structure, Characteristics, Temperature Effects, Comparison with BJTs.
Unit-V

Tuned Amplifiers: Tuned Voltage Amplifier, stagger tuned and double tuned amplifiers, Class- C Amplifier, RF Amplifiers.

Text book:

1. Millman & Halkias/Integrated Electronics/TMH, Analog and Digital **Circuit** and Systems | 2nd Edition July 2017. by **Jacob Millman** (Author), Christos **Halkias**
2. Shail Jain & D.R. Choudhary/Linear Integrated Circuit/PHI, **4th Ed**. (ISBN 9788122430981)

References:

1. Boylstad & Neshlshky/Electronics Devices & Circuits/PHI, (**11th Edition**), 2017
2. Sedra Smith / Microelectronic /Oxford University Press, (**7th Edition**), 2015

Course Code: ECE – S302 Breakup: 3 1 0 4

Course Name: Signal & Systems

Course Outcome:

CO1	Understand mathematical description and representation of continuous and discrete time signals and systems and its classification.
CO2	Analyse CT and DT systems in Time domain using convolution
CO3	Represent CT and DT systems in the Frequency domain using Fourier analysis tools like CTFS, CTFT, DTFS and DTFT Plot Fourier transform magnitude and phase functions.
CO4	Conceptualize the effects of sampling a CT signal. The basic concept of probability, random variables & random signals5.Analyze CT and DT systems using
CO5	Laplace transforms and Z Transforms.

Course Details:

Unit – I

Classification of signals

Introduction to signals, Periodic & non periodic, analog & digital, deterministic & random, energy & power signals. Fourier analysis: Fourier series representation of periodic signals, Fourier transform & their properties, singularity function, unit impulse, unit step. Application of Fourier transform for analysis of LTI networks the concept of frequency in continuous & discrete time domain, linear time invariant system definition. Impulse response of LTI system.

Introduction to Fourier series for discrete time periodic signals, discrete Fourier transform, DFT as a linear transformation, properties of DFT such as convolution, multiplication, duality.

Unit – II

Time and frequency characterization

Magnitude phase representation of Fourier transform, frequency response of LTI systems, time domain properties of ideal frequency selective filters, time domain and frequency domain aspects of non-ideal filters.

Unit – III

Random variable & process

Random variable, random process. Correlation function (auto & cross) cumulative distribution function. Probability density function, joint cumulative & distribution and probability density.

Unit – IV

Sampling

Sampling theorem, reconstruction of signals from samples. Effect of sampling, continuous and discrete time signals, transformation of the independent variable. Continuous and discrete time systems. Basic system properties.

Unit – V

Introduction to Z transform

Region of convergence, properties of the Z transform, Inverse transform using counter integration,

complex convolution theorem, Parseval's relation. Unilateral Z transform and its application to difference equation with non-zero initial condition.

Textbook

1. A.V.Oppenphim, A.S.Willsky and S.H.Nawab; signals and systems, prentice Hall. 2nd Edition October 1996
2. B.P.Lathi, Signal and Linear Systems, Oxford University press, New Delhi. January 2006

Reference Books:

1. Roberts, M.J. / "Signals and Systems" / Tata McGraw-Hill, 2006
2. Chen 'Signals & Systems, Oxford University, Press 3rd ed. 2004

Course Code: ECE – S303T **Breakup: 3 0 0 3 Course Name: Measurement & Instrumentation**

Course Outcome:

CO1	General concepts of measurement
CO2	Electrical measurement techniques and classical measuring instruments
CO3	Modern measurement techniques and instruments
CO4	Brief concepts of sensors and transducers
CO5	Electronic measurement systems and related components including signal generators, analysers, data acquisition systems, storage and display devices
CO6	Applications of the concepts of electrical and electronic measurement systems in special-purpose measurements including magnetic measurements, fiber optic measurements, RF and microwave measurements

Course Details:

Unit – I

Introduction of Measurement

Static and Dynamic Characteristics of Instruments, Measurement of frequency, phase, time – interval, impedance, power measurement, energy measurement and measurement of distortion.

Unit-II

Primary sensing elements: Cantilever, helical spiral spring, load cells, Bourdon tube, Bellows, Diaphragms

Passive Electrical Transducers:

Resistive: Resistance Thermometers, Resistive displacement Transducers, Resistive strain Transducers, Resistive Pressure Transducers.

Inductive: Inductive thickness transducers, Inductive displacement transducers, Eddy current type Inductive transducers.

Capacitive: Capacitive thickness Transducers, Capacitive displacement Transducers

Active Electrical Transducers

Thermo-Electric Transducers

Piezo-electric Transducers: Force transducers, strain transducers, Torque and pressure transducers, and photoelectric transducers.

Digital Transducers: Digital displacement transducers, Digital tachometers.

Unit III

Recorders and Wave Form Generators

Recorders: XY recorder, strip chart recorders, UV recorders, Magnetic tape recorders Wave Form **Generator:** Oscillators, Square wave generator, triangular wave generator, saw tooth generator, pulse generator, Function generator.

Unit-IV

Advanced Measuring Instruments

Data Loggers, Digital Read Out Systems, Digital Input-Output devices, Analog CRO, Digital storage CRO, Spectrum Analyzer, Logic Analyzer.

Unit V Sensors

Semiconductor sensors, Smart sensors, Micro sensors, IR radiation sensors, Ultrasonic sensors, Fiber optic sensors, chemical sensors, Bio sensors.

Textbook:

1. A.K. Sawhney: Electrical & Electronic Measurement & Instrumentation – Dhanpat Rai & Co. (P) Limited. India January 2015
2. M.M.S. Anand: Electronic Instruments and instrumentation Technology. Prentice Hall India Learning Private Limited, 1 January 2004

Reference:

1. Helfrick & Copper: Modern Electronic Instrumentation & Measuring Techniques – Prentice Hall India Learning Private Limited, 1 January 1992
2. W.D. Cooper: Electronic Instrumentation and Measuring Techniques – PHI, 3rd Edition Jan.1985
3. E.O.doebilin: Measurement Systems – TMH, 6th Edition , July 2017
4. H.S.Kalsi: Electronic Instrumentation-TMH, 3rd Edition. July 2017

Course Code: ECE – S303P Breakup: 0 0 2 1

Course Name: Measurement & Instrumentation Lab

Course Outcome:

CO1	General concepts of measurement
CO2	Electrical measurement techniques and classical measuring instruments
CO3	Modern measurement techniques and instruments
CO4	Brief concepts of sensors and transducers
CO5	Electronic measurement systems and related components including signal generators, analysers, data acquisition systems, storage and display devices
CO6	Applications of the concepts of electrical and electronic measurement systems in special-purpose measurements including magnetic measurements, fibre optic measurements, RF and microwave measurements

Course Details:

List of Experiments:

1. Functional verification of
    a. weighted resistor DAC.
    b. R-2R ladder DAC.
2. Functional verification of
    a. 4-bit counter ADC.
    b. 8 bit SAR counter ADC.
3. To verify characteristics of strain gauge by plotting
    a. Graph between micro-strain versus weight.
    b. Graph between Resistance versus weight.
4. To study Linear Variable Differential Transformer (LVDT).
    a. To determine the linear range.
    b. I/P & O/P characteristics.
    c. Calibration as displacement meter and to determine the sensitivity of instruments.
    d. To determine the thickness of a given object.
    e. To study phase shift on CRO.
5. To study the characteristics of Load Cell
6. Study of Optical Transducer
    a. To study the characteristics of Filament Lamp.
    b. To study the characteristics of Photovoltaic Cell.
    c. To study the characteristics of Photoconductive cell.

d. To study the characteristics of PIN Photodiode.

e. To study the characteristics of Characteristics of phototransistor.

7. Study of Temperature Transducer

a. To study the characteristics of IC temperature sensors.

b. To study the characteristics of Platinum RTD.

c. To study the characteristics of NTC thermistor.

d. To study the characteristics of NTC Bridge Circuit.

e. To study the characteristics of K type Thermocouple.

Course Code: ECE – S304T Breakup: 3 0 0 3

Course Name: Microprocessor

Course Outcome:

CO1	To define the history of microprocessors,
CO2	Describe the architectures of 8085 and 8086 microprocessors, draw timing diagram, Write programs using 8085 and 8086.
CO3	Distinguish between the different modules of operation of microprocessors.
CO4	Interface peripherals to Microprocessor.
CO5	Interfacing of memory with Microprocessor.
CO6	Architecture of Microcontroller
CO7	Basic Assembly language programming concept.

Course Details:

Unit-I

Introduction to Microprocessor:

Evolution of Microprocessors, Register structure, ALU, Bus Organization, Timing and Control. Introduction to 8085: Architecture, Programming and Interfacing.

Architecture of 16 bit and 32 bit Microprocessor: Internal organization of 8086, Bus interface unit, Execution unit, Register organization, Sequential memory organization, Bus cycle.

Unit-II

Assembly Language Programming:

Addressing modes, Data transfer instructions, Arithmetical and logical instructions, Program control Instructions (jumps, conditional jumps and subroutine calls), Loop and string instructions, Assembler Directives.

Parameter passing and recursive procedures.

Unit- III

CPU Module Design:

Signal Description of pins of 8086 and 8088, Clock generation, Address and data bus De-multiplexing, Buffering memory organization, Read and Write Cycle Timings, Interrupt structures, Minimum Mode CPU Module, Maximum Mode Operation (Coprocessor configuration)

Features of Numeric processor 8087, Floating point representation, range resolution, normalization, representation of zero, unused codes, parity bit and error detection.

Unit- IV

Basic of Interfacing:

Programmed I/O, Interrupt driven I/O, DMA (8257), Parallel I/O (8255-PPI), Serial I/O (8251/8250, RS-232 standard)

8259 Programmable Interrupt Controller, 8237-DMA Controller, 8253/8254 Programmable Timer/Counter, (8279) Keyboard and display interface, ADC and DAC interfacing.

Unit-V

Memory Interfacing:

Types of memory, RAM and ROM Interfacing with Timing consideration, DRAM

Interfacing, Troubleshooting and Memory Module.

Unit-VI

An Introduction to Microcontroller 8051: The 8051 Architecture, Instruction set, Basic Assembly language programming concept.

Textbooks:

1. Douglas V.Hall / 8086 Microprocessors Architecture / TMH / 3rdEd., July 2017
2. R.Gaonker / 8085 Microprocessor / Penram International Publishing / 6thEd., Oct 2013
3. Kenneth J.Ayala / The 8051 Microcontroller / Penram International Publishing. **3rd** Edition.2007

References:

1. Liu Gibson / Microprocessor 2nd Edition 13 January 1986.
2. Ray, A.K. & Burchandi, K.M. / "Advanced Microprocessors and Peripherals: Architecture, Programming and Interfacing" / Tata McGraw Hill. 3rdEd., July 2017
3. Brey, Barry B. / "INTEL microprocessors" / Prentice Hall (India) /8thEd. June 2008

Course Code: ECE – S304P **Breakup: 0 0 3 2**

Course Name: Microprocessors Lab

Course Outcome:

CO1	To define the history of microprocessors,
CO2	Describe the architectures of 8085 and 8086 microprocessors, draw timing diagram, Write programs using 8085 and 8086.
CO3	Distinguish between the different modules of operation of microprocessors.
CO4	Interface peripherals to Microprocessor.
CO5	Interfacing of memory with Microprocessor.
CO6	Architecture of Microcontroller
CO7	Basic Assembly language programming concept.

Course Details:

8085/8086 Based Experiments:

1. Signed and unsigned binary addition.
2. Signed Multiplication.
3. Signed and unsigned binary division.
4. BCD Addition and subtraction
5. Look up table method for finding the ASCII of an alpha-numeric code.
6. Interfacing with 8255 in I/O mode/BSR mode.
7. Interfacing with seven segment display.
8. Interfacing with 8253.
9. Verification of Interrupts.
10. Interfacing with ADC/DAC.
11. Mini Project on some interfacing applications.

Course Code: ECE – S305 **Breakup:** 3 1 0 4

Course Name: Electrical Engineering Materials

Course Outcome:

CO1	Selection of materials for modern engineering applications.
CO2	Structure and properties of metals, ceramics and polymers starting with fundamental atomic.
CO3	Identify the fabrication methods of integrated circuits,
CO4	Classify and describe the semiconductor devices for special Applications.
CO5	Applications and properties of dielectric materials & magnetic materials.

Course Details:

Unit – I

Crystal Structure of Materials:

A. Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth.

B. Energy bands in solids, classification of materials using energy band, direct and indirect band gap materials, synthesis of alloy semiconductors.

Unit – II

Conductivity of Metals:

Electron theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat developed in current carrying conductors, thermoelectric effect, superconductivity and super conducting materials, Properties and applications of electrical conducting and insulating materials, mechanical properties of metals.

Unit – III

Mechanism of Conduction in semiconductor materials:

Types of semiconductors, current carriers in semiconductors, Half effect, Drift and Diffusion currents, continuity equation, P-N junction diode, junction transistor, FET & IGFET, properties of semiconducting materials.

Unit – IV

Magnetic & Dielectric Properties of Material:

Origin of permanent magnetic dipoles in matters, Classification: Diamagnetism, Para magnetism, Ferromagnetism, Anti-ferromagnetism and Ferrimagnetism's, magnetostriction, Properties of magnetic materials, soft and hard magnetic materials, permanent magnetic materials.

Effect of dielectric on the behavior of a capacitor, Polarization, Frequency dependence of electronic polarizability & permittivity, dielectric losses and loss tangent, dipolar relaxation, frequency and temperature dependence of the dielectric constant of polar dielectrics, Ferro-electricity and piezoelectricity

Unit – V

Electrical Components: Different kind of resistances carbon, metal film, wire wound, capacitances: electrolytic ceramic, Inductors, transformers, audio, video RF, IF, RF chokes.

Text Books:

1. A.J. Dekker," Electrical Engineering Materials" Prentice Hall of India , **January 1970**

2. R.K. Rajput," Electrical Engg. Materials," Laxmi Publications.2004
3. C.S. Indulkar & S.Triruvagdan "An Introduction to Electrical Engg. Materials, S.Chand & Co.-2006.

References:

1. Solymar, "Electrical Properties of Materials" Oxford University Press.
2. Ian P. Hones," Material Science for Electrical and Electronic Engineering," Oxford University Press.

Course Code: ECE – S306 Breakup: 3 1 0 4

Course Name: Automatic Control System

Course Outcome:

CO1	Categorize different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form.
CO2	Characterize any system in Laplace domain to illustrate different specification of the system using transfer function concept.
CO3	Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
CO4	Employ time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions.
CO5	Formulate different types of analysis in frequency domain to explain the nature of stability of the system.
CO6	Identify the needs of different types of controllers and compensator to ascertain the required dynamic response from the system.

Course Details:

Unit – I

Input/output relationship: Introduction to open loop and closed loop control systems. Mathematical representation of physical systems. Transfer functions block diagram and signal flow graph. Reduction algebra, masons gain. Time domain performance criterion, Transient response of first order, second order & Higher Order Systems.

Unit – II

Error analysis: Static and Dynamic error coefficients. Ersor criterion, frequency Domain analysis polar and inverse polar plots, bode plot, Frequency domain specifications. Relative stability gain margin and phase margin, correlation with time domain, W & N circles.

Unit – III

Stability theory: concept of stability, asymptotic & Conditional stability, Routh Hurwitz criterion, Nyquist stability criterion, Liapunova's Direct Method, Root Locus plots.

Unit – IV

Compensation Techniques: Concept Lag and Lead & lag lead Networks, Design of closed loop Systems Using Compensation Techniques.

Unit – V

State Space Analysis of Control Systems: State Space Representation, Solution to Homogeneous State Equation, State Transition Matrix, Time Invariant State Equations, linear time varying systems, Controllability and Observability, Vandermonde Matrix, Decomposition of Transfer Function.

Unit- VI

Non Linear Systems: Introduction, Some Common Types of Non-Linearities, Classification of Non-Linearity, Study of Non-Linear Systems, Describing Function method of Analysis, Phase Plane Analysis, Stability Analysis with Describing Functions.

Textbooks:

1. KUO B.CI Automatic control system/Pill. 6th Revised ed. October 1990
2. Ogata K.J Modern Control Engineering / PHI. 5th ed. October 2009.

Reference Books:

1. Nagrath I.J. & Gopal, M/Control Systems Engineering/New Age International. Seventh ed. September 2021
2. S.N. Sivanandam/Control Systems Engineering /Vikas Publishing House Pvt. Ltd. Vikas Publication House Pvt Ltd, January 2007.

Course Code: ECE – S307T Breakup: 3 0 0 3

Course Name: Analog Integrated Circuits

Course Outcome:

CO1	Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
CO2	Elucidate and design the linear and non-linear applications of an op amp and special application ICs.
CO3	Explain and compare the working of multivibrators using special application IC 555 and general purpose amp.
CO4	Classify and comprehend the working principle of data converters.
CO5	Illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication

Course Details:

Unit – I

Basic IC Op-Amp Fundamentals:

Brief review of differential amplifier, current mirror, active load, level shifter, output stage; ac and dc characteristics. Basic building blocks of OP – AMPS.

Unit – II

Inverting /Non-inverting VCVS, Integrators, Differentiators, CCVS and VCCS, instrumentation Amplifiers, bi-quad filter (LP, HP, BP and Notch), Oscillators. Logarithmic amplifiers, Precision rectifier, peak detector, sample and hold circuits. OP – AMP as comparator, Schmitt trigger, square and triangular wave generator, Monostable Multi-vibrator, IC Analog Multiplexer and De-multiplexer.

Unit – III

Voltage Regulators:

Transistorized series-pass Regulator, Overload short circuit and Thermal shut-down protection, OP – AMP Regulators, IC Regulators, fixed voltage regulators (78/79, XX), 723 IC Regulators (Current limiting, Current fold back); SMPS.

Unit – IV

Data Converters:

Analog to digital & DAC, weighted resistor & binary ladder D/A converters, single & dual slope integration, counter, successive approximation, resistor type A/D converters.

Unit – V

Signal generators and wave shaping circuits:

IC timer (555) applications, Monostable and Astable operation. Ramp Generator: Triangle generator, Saw-tooth generator

PLL : Principle, definition and applications, Linear model of PLL, phase detectors, voltage controlled oscillators, loop filters, FM demodulation, using PLL digital PLL steady state, stability and transient analysis of PLL frequency synthesizer**,** Direct frequency synthesis analysis of PLL as a frequency synthesizer, direct digital synthesis.

Textbooks:

1. Sedra Smith Microelectronics / Oxford Universities Press., 1 June 2017
2. Gayakwad / OP Amps and Linear Integrated circuits / PHI. **Fourth** Edition, **29 May 2015**

References:

1. C.S. Soclof / Application of analog Integrator circuits / PHI.2011
2. D. P. Singh / Semiconductor devices and circuits / Dhanpat Rai & Co.1999
3. Jacob applications & Design with analog ICs / PHI 1996.

Course Code: ECE – S307P Breakup: 0 0 3 2

Course Name: Analog Integrated Circuits Lab

Course Outcome:

CO1	Infer the DC and AC characteristics of operational amplifiers and its effect on output and their compensation techniques.
CO2	Elucidate and design the linear and non-linear applications of an op amp and special application ICs.
CO3	Explain and compare the working of multivibrators using special application IC 555 and general purpose amp.
CO4	Classify and comprehend the working principle of data converters.
CO5	Illustrate the function of application specific ICs such as Voltage regulators, PLL and its application in communication

Course Details:

List of Experiments:

1. Measurement of Op-amp Parameters. (Gain, Input offset Voltage, CMRR, Slew rate).
2. Determination of Frequency response of Op-Amp.
3. Op Amp as Adder, Subtractor & Integrator, Instrumentation Amplifier
4. Precision Rectifier.
5. Instrumentation Amplifier.
6. Open Loop operation of Op-amp -Comparators - Schmitt Trigger.
7. Astable & Monostable Operation Using 555.
8. IC Voltage Regulator.
9. Voltage Controlled Oscillator.
10. Phase Locked Loop.
11. Frequency Multiplier.
12. A/D Converters & D/A Converters.
13. Second Order Active Filter- High Pass & Low Pass Realization.

Course Code: ECE – S308T Breakup: 3 0 0 3

Course Name: Communication Systems

Course outcome:

CO1	Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
CO2	Amplitude modulation, DBBSC, SSBSC VSBSC,
CO3	Frequency modulation and demodulations, PAM, PWM, PPM and
CO4	Digital modulation techniques such as ASK, FSK, PSK.

Course Details:

Unit-I

Communication System

Elements of communication System and its Fundamental limitations, Need of Modulation.

Random Processes

Random Process, Stationary Processes, Ergodic Processes, Transmission through LTI, Power spectral density, Gaussian process.

Noise

External and internal sources of noise, Thermal noise, Calculation of thermal noise, Shot noise, Noise figure, Noise temperature, Equivalent noise bandwidth.

Unit-II

Amplitude (Linear Modulation)

Generation and detection of DSB, SSB, VSB, Carrier Acquisition, Concept of FDM, AM transmitter and Receiver

Unit-III

Angle (Exponential Modulation)

Types of Angle Modulation, Concepts of Instantaneous frequency, Wideband and Narrowband FM, Generation and detection of FM, Generation and detection of PM, FDM

Unit-IV

Noise performance of CW Modulation Systems

Noise in DSB-SC, SSB-SC and AM system, Noise in FM and PM FM threshold and its extension, Pre-emphasis and De-emphasis in FM **Unit-V**

Sampling theory & pulse modulation

Sampling process, sampling theorem, signal reconstruction, flat top sampling of band pass signals, Analog Pulse Modulation: Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Spectra of pulse modulation, concept of time division multiplexing.

Text books:

1. Communication Systems S. Haykin, John Willy & Sons.4th ed.2006.
2. Communication Systems: A.B. Carlson, TMH.2007.
3. Modem Analog & Digital Communication Systems: B.P. Lathi, Oxford Univ. Press.4th ed. 2009.
4. Analog Communication Systems: P Chakrabarti, Dhanpat Rai.2018.

Reference Books:

1. Taub, Herbert & Schilling, Donald L. / "Communication Systems" / Tata McGraw-Hill-2017.
2. Carlson, A. Bruce, Crilly, Paul B. & Rutledge, Janet C. / "Communication Systems an Introduction to Signals & Noise in Electrical Communication"/ Tata McGraw-Hill.-2007.
3. Kennedy, George & Davis, Bernard / "Electronic Communication Systems" / Tata McGraw-Hill / 5th Ed.2011.
4. Singh, R.P. & Sapre, S.D. / "Communication Systems: Analog & Digital" / Tata McGraw- Hill.-2004
5.

Course Code: ECE – S308P Breakup: 0 0 3 2

Course Name: Communication Systems Lab

Course outcome:

CO1	Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
CO2	Amplitude modulation, DBBSC, SSBSC VSBSC,
CO3	Frequency modulation and demodulations, PAM, PWM, PPM and
CO4	Digital modulation techniques such as ASK, FSK, PSK.

Course Details:

List of Experiments:

1. Generation of AM Signal and measurement of Modulation Index.
2. Envelop Detector for AM Signals
3. Generation & Detection of DSB-SC Signal.
4. SSB Generation.
5. To study the Varactor modulator.
6. To study the Reactance modulator.
7. Detection of SSB signal
8. Generation of NBFM Signal.
9. Generation of FM Signal.
10. FM Detector using PLL.

Course Code: ECE – S309 Breakup: 3 1 0 4

Course Name: Antenna and Microwave Engineering

Course Outcome:

CO1	Explain different parameters of antenna and antenna systems
CO2	Apply knowledge gained on modelling and performance analysis of various antenna types.
CO3	Design, synthesize and analyse the types of antennas.
CO4	Model and Compute the radiation characteristics and other performance parameters.
CO5	Explain different types of waveguides and their respective modes of propagation.
CO6	Analyse typical microwave networks using impedance, admittance, transmission and scattering matrix representations.
CO7	Design microwave matching networks using L section, single and double stub and quarter wave transformer.
CO8	Explain working of microwave passive circuits such as isolator, circulator, Directional couplers, attenuators etc.
CO9	Describe and explain working of microwave tubes and solid state devices.

Course Details:

Unit-I

Antenna Principles

The Alternating Current Element, Electric and Magnetic Fields due to Alternating current element, Application to short antennas, Radiation from Monopole and Half-Wave Dipole, Assumed current distribution.

Antenna Fundamentals: Application of Network Theorems to antennas, Equivalence of Directional Patterns, Equivalence of Transmitting and Receiving antenna impedances, Equality of effective lengths using Reciprocity Theorem, Directional properties of Dipole Antennas, Antenna Gain, Directivity, Effective Area, Antenna Terminal Impedance, Antenna as an Opened Out Transmission Line, Practical Antennas and Methods of Excitation, Transmission loss between antennas, Antenna Temperature and Signal to Noise Ratio.

Unit-II

Antenna Arrays

Two-Element Array, Horizontal Patterns in Broadcast Arrays, Linear Arrays, Broad-side and End-fire, Multiplication of Patterns, Effect of Earth on Vertical Patterns, Binomial array, Tchebycheyff Distribution Array.

Unit-III

Wave Propagation

Modes of Propagation, Plane Earth Reflection, Surface Wave, Field strength, Elevated Dipole Antennas above a Plane Earth, Wave tilt of the Surface Wave, Spherical Earth Propagation, Tropospheric Wave. Ionosphere Propagation, Sky Wave Transmission Calculations, Effect of the Earth's Magnetic Field, Virtual Height, MUF/LUF, Skip distance, Ionospheric Variations and Fading.

Space Waves: Radio Horizon, Microwave space wave Propagation, Duct Propagation.

Unit-IV

Wave Guides

Guided waves between parallel plates, Dielectric slab Waveguide, Rectangular, Circular waveguides, Transmission Line Analogy for waveguides.

Microwave Components

Waveguide couplings, bends and twists, tees, transitions, matched load, Attenuators and phase shifters, wave guide discontinuities, windows Irises and tuning screws, Two-hole directional coupler, Isolators and circulators.

Unit-V

Microwave Generation

Limitations of Conventional Vacuum Tubes, Klystron (Reflex and Multi-cavity), TWT, Magnetrons, and BWO, **Negative conductance Microwave devices**: Tunnel diode, Gunn diode, IMPATT diode

Text books:

1. Jordan and Balmian, **'Electromagnetic waves and radiating systems'**, PHI.-2015
2. K.D.Prasad,**'Antenna and Wave propagation'**,Pragati Prakashan,2009
3. Liao,Y, "**Microwave Devices and Circuits**", Prentice Hall of India.-2003
4. S.Kulkarni," **Microwave Engineering**", Umesh Publication,2009.

References:

1. Reich, "**Microwave principles**", CBS, 1996.
2. Collin, "**Foundation of Microwave Engineering**", 2nd cd. McGraw Hill, 1992.
3. Watson, "**Microwave Semiconductor Devices and Their Circuit Applications**", McGraw Hill, 2015
4. J.D.Krauss,'**Antennas**', TMH.- November 2017

Course Code: ECE – S401T **Breakup: 3 0 0 3**

Course Name: Digital Communication

Course Outcome:

CO1	Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
CO2	Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.
CO3	Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.
CO4	Describe and analyse the digital communication system with spread spectrum modulation.
CO5	Design optimal detectors in presence of WGN.

Course Details:

Unit – I

Elements of Digital communication and information theory : Model of a digital communication system ; logarithmic measure of information, entropy and information rate, conditional entropy and redundancy, source coding fixed and variable length code words, Source coding theorem, prefix doing and craft inequality, Shannon – fano and Huffman coding for 1^{st} , 2^{nd} and 3^{rd} order extensions, maximum entropy of a continuous source(with Gaussian distribution) entropy of a band limited white Gaussian noise, Mutual information and channel capacity of a discrete memory less channel, of a BSC, Hartley Shannon law.

Unit –II

Waveform coding techniques: Discretization in time and amplitude. Linear quantizer, quantization noise power calculation, signal to quantization noise ratio, non – uniform quantizer, A law & μ law companding; encoding and pulse code modulation, bandwidth of PCM, Differential pulse code modulation, Delta modulation, Idling noise and slope overload, Adaptive delta modulation, adaptive DPCM. Comparison of PCM and DM, MPEG audio coding standard.

Digital multiplexing: Fundamentals of time division multiplexing, electronic commutator, bit, byte interleaving E1 Carrier system, Synchronization and signaling of E1, TDM, PCM hierarchy.

Unit – III

Digital Baseband transmission: line coding and its properties. NRZ & RZ types, signaling format for Unipolar, polar, bipolar, AMI & Manchester coding and their power spectra (No derivation), HDB and B&W signaling, ISI, Nyquist criterion for zero ISI & raised cosine spectrum. Matched filter receiver, derivation of its, impulse response and peak pulse signal to noise, correlation detector decision threshold and error probability for binary Unipolar (on – off), signaling.

Unit – IV

Digital modulation techniques: Types of digital modulation, wave forms for amplitude, frequency and phase shift keying. Method of generation and detection of coherent & non – coherent binary ASK, FSK & PSK, differential phase shift keying, Quadrature modulation techniques (QPSK and MSK) probability of error and comparison of various digital modulation techniques.

Unit – V

Error control coding: Error free communication over a noisy channel, Hamming sphere, hamming

distance and hamming bound, relation between minimum distance and error detecting and correcting capability, linear block codes, encoding & syndrome decoding; cyclic codes, encoders and decoders for systematic cycle codes ; convolutional codes, code tree & Trellis diagram, Viterbi and sequential decoding, burst error correction, comparison of performance.

Textbooks:

1. P. Lathi/Modern Analog 86 Digital Communication/ Oxford Univ Press.5th Ed.-2018
2. Simon Haykin /Digital Communication /John Wiley.-1988
3. Simon Haykin/Communication Systems. John Wiley Qv Edn.4th Ed.-2006

References Books:

1. Taub & Schilling / "Principles of Communication Systems" / Tata McGraw-Hill /2017
2. Singh, R.P. & Sapre, S.D. / "Communication Systems: Analog & Digital" / Tata McGraw-Hill.-2006
3. A.B. Carlson / "Communication Systems" / Tata McGraw-Hill.5th Ed.-2011
4. Prokis J.J / "Digital Communications" / McGraw Hill /5th Ed.-2007
5. Schaum's Outlines / "Analog & Digital Communication" / Tata McGraw-Hill.-2017
6. Kennedy, George & Davis, Bernard / "Electronic communication systems" / Tata McGraw-Hill-1999

Course Code: **ECE – S401P** **Breakup:** **0 0 3 2**

Course Name: **Digital Communication Lab**

Course Outcome:

CO1	Apply the knowledge of statistical theory of communication and explain the conventional digital communication system.
CO2	Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise.
CO3	Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code.
CO4	Describe and analyse the digital communication system with spread spectrum modulation.
CO5	Design optimal detectors in presence of WGN.

Course Details:

List of Experiments:

1. Sample and hold circuit.
2. To study the analog signal, sampling and reconstruction.
3. PAM, PWM, PPM generation and detection.
4. Delta modulation and detection.
5. Pulse data coding and decoding techniques for NRZ formats
6. ASK, FSK, PSK modulation and detection
7. Single bit error detection and correction.
8. PCM Modulation and detection

Course Code: ECE – S402 Breakup: 3 1 0 4

Course Name: Data Communication

Course Outcome:

CO1	To understand the basic principles of network design.
CO2	The concept of data communication within the network environment.
CO3	Understanding the conflicting issues and resolution techniques in data transmission.
CO4	The setting up of a network environment with all the necessary data communication components, procedure and techniques that make it functional.

Course Details:

Unit-I

1. **Data transmission basics:** Review of digital data analog modulation and digital formats. Data rates, baud rates, channel capacity, mediums for communication. Synchronous and asynchronous data communication.
2. ISO – OSI model and TCP/IP model of network, protocols and services, connection oriented and connectionless service, their interpretation at different layers. Quality of services. Design issues for different layers.
3. **Physical Layer**: Design issues, Data link layer design issues, services provided to network layer framing necessity and techniques. Error control feature and review of techniques. Flow control; sliding window protocols: go back and selective repeat. Example data link protocols SLIP, PPP

Unit – II

Medium access sub layer: in broadcast channels. ALOHAS analysis, CSMA protocols, collision detection. Collision free protocols: binary countdown, limited contention protocols adaptive tree walk compromise between high load channel. Utilization and low load delay.

Unit – III

Examples of IEEE 802.3, 802.4, 802.5, 802.6 LAN/MAN framing, medium, operation and MAC 802.3 performance switches. Fast Ethernet, bridges 802.2 LLC, FDDI wireless LAN MEE 802.11.

Unit – IV

Network layer: Services provided to transport layer. Routing algorithms: Dijkstra's algorithm for shortest path, flooding, flow based routing, distance vector routing, link stat routing hierarchal routing, routing for mobile hosts congestion control: in virtual circuits subnets: choke packets, Internetworking. Internet IP addresses IP protocol basics.

Unit – V

Transport layer: Services provided to the upper layers. Elements of transport protocols establishing: addressing and releasing connection and flow control and buffering Introduction to network security.

Textbooks:

1. Computer Networks by Tanenbaum/PHI.5th Ed.-2013
2. Data Networks: Bertsekas & Gallager.2nd Ed.-1991

Reference Books:

1. Black U. / "Computer Networks: Protocols, Standards and Interfaces" / Prentice Hall (India) / 2nd Ed.-1991
2. Shay, William A. / "Understanding Data communications & Networks" / Vikas Publishing House Pvt. Ltd.-1999

Course Code: ECE – S403T Breakup: 3 0 0 3

Course Name: Digital Signal Processing

Course Outcomes:

CO1	Interpret, represent and process discrete/digital signals and systems.
CO2	Thorough understanding of frequency domain analysis of discrete time signals.
CO3	Ability to design & analyse DSP systems like FIR and IIR Filter etc.
CO4	Practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
CO5	Understanding of spectral analysis of the signals

Course Details:

Unit-I Introduction

Limitations of analog signal processing, Advantage digital signal processing, discrete time characterization of signals & systems some elementary discrete time sequences and systems, concepts of stability, causality, linearity time invariance and memory, linear time invariant systems, and their properties, linear constant coefficient difference equations.
Frequency domain representation of discrete time signal and systems complex exponentials as Eigen function of LTI systems, Fourier transform of sequences.

Unit-II
Processing of continuous time signals
Discrete time processing of continuous time signals and vice – versa; decimation & interpolation; changing the sampling rate by integer and non-integer factors using discrete time processing.
Discrete Fourier transform
DFT and its properties; linear, periodic and circular convolution, linear filtering methods based on DFT, filtering of long data sequences; fast Fourier transform algorithm using decimation in time and decimation in frequency techniques; linear filtering approaches to computation of DFT.

Unit-III
Transform analysis of LTI systems
Frequency response of LTI systems, system function for system characterized by linear constant coefficient difference equations. Relationship between magnitude and phase; all pass systems, minimum phase systems.
Structure for discrete time systems
Signal flow graph representation, transposed forms, lattice structures.

Unit-IV
Design of digital filters
Linear phase FIR filters; FIR differentiator and Hilbert transforms, FIR filter design by impulse invariance, bilinear transformation; Matched Z – transformation; frequency transformation in the analog and digital domain.

Unit-V
Finite precision effects
Fixed point and floating point representations, effect of coefficient quantization, effect of round off noise in digital filters, limit cycles.

Digital signal processors

Architecture and various features of TMS/ADSP, series of digital signal processors;
Instruction set and few applications of TMS 320CXX.

Textbooks:

1. Oppenhiem, A.V & Sachsfer R.W, "Discrete Time Signal Processing" Prentice Hall, 1989.
2. Proakis, J.G & Manolakis, D.G, "Digital Signal Processing" Prentice Hall 1992.

Reference Books:

1. Rabiner, L.R. and Gold B./ "Theory and applications of DSP" / Prentice Hall (India)
2. Oppenheim, Alan V. & Willsky, Alan S. / "Signals and Systems" / Prentice Hall (India) / 2nd Ed.1996
3. Johnson, J.R. / "Introduction to Digital Signal Processing" / Prentice Hall (India)-1992
4. DeFatta, D.J., Lucas, J.G. & Hodgkiss, W.S / "Digital Signal Processing"/ John Wiley & Sons.-July 2009
5. Sen M. Kuo & Woon-Seng S. Gan, "Digital Signal Processors-architectures, implementation and applications" / Pearson Education / Ist Ed. /2004

Course Code: ECE – S403P **Breakup: 0 0 3 2**

Course Name: Digital Signal Processing Lab

Course Outcomes:

CO1	Interpret, represent and process discrete/digital signals and systems.
CO2	Thorough understanding of frequency domain analysis of discrete time signals.
CO3	Ability to design & analyse DSP systems like FIR and IIR Filter etc.
CO4	Practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors.
CO5	Understanding of spectral analysis of the signals

Course Details:

List of Experiments:

1. Sampling & Waveform Generation.
2. Plot the different sequences using MATLAB tools: -
   (i) Unit step sequence (ii) Unit Impulse Sequence (iii) Unit Ramp Sequence
3. Quantization
4. Circular convolution of sequences.
5. Periodic convolution of sequences.
6. DFT Computation.
7. Fast Fourier Transform Implementation.
8. FIR Filter implementation.
9. IIR Filter implementation.
10. Computational Experiments with Digital Filters.

Course Code: ECE – S404T **Breakup: 3 0 0 3**

Course Name: Wireless & Mobile Communication

Course Outcome:

CO1	Cellular concepts like frequency reuse, fading, equalization, GSM, CDMA.
CO2	Apply the concept to calculate link budget using path loss model
CO3	They can analyse different multiple access techniques in mobile communication with
CO4	Equalization and different diversity techniques and can apply the concept of GSM in real time applications.

Course Details:

Unit-I

Introduction: History of wireless communication, Evolution of Mobile Communication, Mobile and Wireless devices. A market for mobile communications. A simplified reference model for mobile communications, Large scale path loss: propagation models, reflection, diffraction, scattering, practical link budget design using path loss model.

Wireless-transmission: A brief introduction of frequencies for radio transmission, signals propagation, Multiplexing, Modulation, spread spectrum, cellular system, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, Small scale fading & multipath propagation and measurements, impulse response model and parameters of multipath channels, types of fading, theory of multi-path shape factor for fading wireless channels.

Unit-II

Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread spectrum (DS-SS), frequency hopped spread spectrum(FHSS), performance of DS-SS, performance of FH-SS, modulation performance in fading and multipath channels, fundamentals of equalization, equalizer in communication receiver, survey of equalization techniques, linear equalizer, linear equalizer, non-linear equalization, diversity techniques, RAKE receiver.

Medium Access Control: Introduction to MAC, Telecommunication systems, GSM, DECT, TETRA, UMTS & IMT-2000

Unit-III

Satellite System: Review of the System, Broadcast System-Review.

Wireless LAN: IEEE 802-11 Protocol, System Architecture, Protocol Architecture, Physical Layer & MAC Layer, Newer developments, Hiper LAN, Bluetooth Technology, Introduction to wireless networks, 2G, 3G wireless systems, wireless standards.

Unit-IV

Mobile Network Layer: Mobile IP, Mobile host configuration Network, Mobile ad- hoc networks

Mobile transport Layer: Traditional TCP, classical TCP improvement TCP over wireless network, performance Enhancing, proxies

Support for Mobility: File systems, World Wide Web, wireless application protocol, i-mode, Sync ML, WAP2-0 etc. Architecture of future Network & Applications.

Text Book:

1. Schiller, J. / “Mobile Communication” / Pearson Education / 2nd Ed.-2008
2. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson-2010

Reference Books:

1. Willium C. Y. Lee, “Mobile communication Design and fundamentals” / 2nd Ed.-2011
2. D. R. Kamilo Fehar, “Wireless digital communication” Prentice Hall, May 1995
3. Haykin S & Moher M., “Modern wireless communication”, Pearson, 2005.

Course Code: ECE – S404P **Breakup: 0 0 3 2**

Course Name: Wireless & Mobile Communication Lab

Course Outcome:

CO1	Cellular concepts like frequency reuse, fading, equalization, GSM, CDMA.
CO2	Apply the concept to calculate link budget using path loss model
CO3	They can analyse different multiple access techniques in mobile communication with
CO4	Equalization and different diversity techniques and can apply the concept of GSM in real time applications.

Course Details:

List of Experiments:

1. Selection and study of various PN code (MLS, GOLD, BARKER).
2. Generate (spreading) DS-SS modulated signal.
3. To demodulate (dispreading) DS-SS modulated signal.
4. Selection & comparative study of various code modulation techniques: BPSK/ QPSK/ OQPSK.
5. Modulation and Demodulation using internal generation of 2047 bit PN sequence as modulator Input and Unmodulated carrier.
6. Spreading and Despreading using Additive white Gaussian Noise Generator and frequency offset.
7. Voice communication using DSSS.
8. To set up Active Satellite link.
9. Study satellite transponder.
10. Generation & Detection of VSB signal.
11. Measurement of VSWR
12. Study of Characteristics of Reflex Klystron and Gunn Oscillator.
13. Measurement of coupling Coefficient and directivity of a directional coupler
14. Study of insertion and coupling Coefficient of Magic Tee
15. Directional pattern of different antennas.

Course Code: ECE – S405T **Breakup: 3 0 0 3**

Course Name: Optical Communication

Course outcome:

CO1	Recognize and classify the structures of Optical fibre and types.
CO2	Transmission Characteristics of fibre like attenuation and dispersion. Analyse various coupling losses.
CO3	Manufacturing techniques of fibre/cable.
CO4	Principle and operation of the optical sources and detectors such as LASER, LED& APD.
CO5	Optical Amplifier: The basic concepts of optical networks, Describe about the SONET/SDH, WDM.
CO6	Familiar with Design considerations of fibre optic systems, OTDR. Non communicational applications of optical fibre
CO7	To perform characteristics of optical fibre, sources and detectors, design as well as conduct experiments in software and hardware, analyse the results to provide valid conclusions.

Course Details:

Unit – I
Overview of optical fiber wave guides
General system, transmission link, advantage of optical fiber communication, basic structure of optical fiber waveguide, ray theory transmission, optical fiber modes and configuration, step index & graded index fiber, single mode fiber, fiber materials, fiber fabrication.

Unit – II
Signal degradation in optical fiber
Introduction, attenuation, intrinsic & extrinsic absorption losses, linear & nonlinear scattering losses, bending losses, distortion in optical wave guide, intramodal and intermodal dispersion.
Power launching and coupling
Source to fiber power launching, power calculation, lensing schemes, fiber to fiber joints, fiber splicing technique, fiber connectors.

Unit – III Opticalsources
LASER: Basic concepts of laser, Optical emission from semiconductors, Semiconductor injection laser (ILD), Injection laser characteristics. LED: power and efficiency, LED structures, LED characteristics.
Optical detectors: p-n photodiodes, p-i-n photodiodes, Avalanche photodiodes, Quantum efficiency, speed of response, Phototransistor.

Unit – IV Optical receiver
Receiver operation, digital receiver noise, shot noise, pre-amplifier types, Digital receiver performance, introduction to analog receivers.

Unit – V
Digital transmission systems
Point to point links, system considerations, link power budget, rise time budget, modulation formats for analog communication system, introduction to WDM concepts, Introduction to advanced multiplexing strategies.

Textbooks:

1. G.Keiser: Optical Fiber Communication – **McGraw Hill Education, Fifth Ed. July 2017**
2. Jenkins & White: Fundamentals of Optics – MGH,4th ed. 2017
3. J.M. Senior: Optical Fiber Communication – PHI-3rd ed. 2010
4. Gagliardi & Karp: Optical Communication – Wiley-2nd ed. 1995

Reference Books:

1. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / Pearson Education.-2017
2. Singh, Jasprit / "Optoelectronics an Introduction to Materials and Devices"/ McGraw-Hill-1996
3. Khare, R.P. / "Fiber Optics & Optoelectronics" / Oxford University Press-2004
4. Gupta, S.C. / "Text Book of Optical Fiber Communication & Its Applications"/ Prentice–Hall (India).-2013

Course Code: ECE – S405P **Breakup: 0 0 2 1**

Course Name: Optical Communication Lab

Course outcome:

CO1	Recognize and classify the structures of Optical fibre and types.
CO2	Transmission Characteristics of fibre like attenuation and dispersion. Analyse various coupling losses.
CO3	Manufacturing techniques of fibre/cable.
CO4	Principle and operation of the optical sources and detectors such as LASER, LED& APD.
CO5	Optical Amplifier: The basic concepts of optical networks, Describe about the SONET/SDH, WDM.
CO6	Familiar with Design considerations of fibre optic systems, OTDR. Non communicational applications of optical fibre
CO7	To perform characteristics of optical fibre, sources and detectors, design as well as conduct experiments in software and hardware, analyse the results to provide valid conclusions.

Course Details:

List of Experiments:

1. Voice transmission through optical link.
2. AM system using analog & Digital Input Signals.
3. Frequency Modulation System.
4. Pulse Width Modulation system.
5. Study of Propagation Loss in optical fiber System.
6. Study of Bending Loss.
7. Measurement of Numerical Aperture.
8. Characteristics of E-O Converter (LED)
9. Fiber optic digital link.
10. PC to PC communication Link using optical fiber.

Course Code: ECE – S406 **Breakup: 3 1 0 4**

Course Name: VLSI Technology & Design

Course Outcome:

CO1	Identify the various design limits material used for fabrication.
CO2	Describe the Performance of technology scaling.
CO3	Understand the complexities involved in the integrated circuits.
CO4	Apply principles to Identify and Analyze the various steps for the fabrication of various components
CO5	Assess the various reliability issues in VLSI technology
CO6	Analysis of the operation of MOS transistor
CO7	Analysis of the physical design process of VLSI design flow
CO8	Analysis of the design rules and layout diagram
CO9	Design of Adders, Multipliers and memories etc.

Course Details:

Unit-I
Crystal Growth & Wafer Characterization: Electronic Grade Silicon, CZ Crystal Growing, Silicon Shaping, Processing Consideration.
Epitaxy: Vapor Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators.
Oxidation: Growth Mechanism, Oxide Properties, Oxidation Induced Defects
Lithography: Optical Lithography, Electron Lithography, X-Ray Lithography, Ion Lithography
Reactive Plasma Etching: Feature Size Control and Anisotropic, Etch Mechanisms, Reactive Plasma Etching Techniques and Equipment

Unit-II
Diffusion: Models of Diffusion in Solids, Fick's One Dimensional Diffusion Equations, Atomic Diffusion Mechanisms
Ion Implantation: Range Theory, Implantation Equipment, Annealing
Metallization: Metallization Applications, Metallization Choice, Physical Vapour Deposition, Patterning, Bipolar IC Technology

Unit-III
Introduction to MOS: MOS, CMOS IC Technology, Metal Gate, Poly Silicon Gate, P-Channel, N-Channel Devices, Enhancement Mode and Depletion Mode Devices and their Characteristics.

Unit-IV
VLSI design Introduction: Issues in Digital Integrated Circuit Design, Quality Metrics of a Digital Design.
The Manufacturing Process: Manufacturing CMOS Integrated Circuits, Design Rules, IC Layout, Packaging Integrated Circuits, Spice Diode Model, The MOSFET Transistors: The MOS Transistor Under Static Condition, Secondary Effects, Spice Models For the MOS Transistors, Scaling, Circuit Simulation

Unit- V
The CMOS Inverter: The Static CMOS Inverter, Performance of CMOS Inverter, Power, Energy and Energy Delay
Designing Combinational Logic Gates in CMOS: Static CMOS Design, Dynamic CMOS Design,

Simulation and Layout Techniques for Logic Gates
Designing Sequential Logic Circuits: Static Latches and Register, Dynamic Latches and Register.

Unit-VI
Designing Arithmetic Building Blocks
Data paths in Digital Processor Architectures, Adders, Multiplier, Shifter, Other Arithmetic Operators, designing memories, Power and Speed Trade-offs in Data Path Structures.
Implementation Strategies for Digital ICs
Introduction, Custom to semi-custom and structure-array Design Approaches, Custom Circuit Design, Cell based Design Methodology, Array based Implementation Approaches.

Unit-VII
Architecture Design:
VHDL, Register-Transfer Design, High Level Synthesis.

Text Book:

1. Rabaey, John. M. and Chandrakasan, Anantha and Nikolic, Borivoje / "Digital Integrated Circuits, A Design perspective" / Pearson Education / 2nd Ed.-2016
2. Wayne, Wolf / "Modern VLSI Design- Systems on Silicon" / Addison-Wesley / 3rd Ed.2005
3. Sze, S.M./ "VLSI Technology" / Tata McGraw-Hill / 2nd Ed-2011
4. Streetman, B.G. & Banerjee, Sanjay / "Solid State Electronic Devices"/ Prentice Hall (India) / 5th Ed. 2005

Reference Books:

1. Kang, Sun-mo and Leblebici, Yusuf / "CMOS Digital Integrated Circuits, Analysis & Design"/ Tata McGraw-Hill /2003
2. Pucknell, Douglas A. and Eshraghian, Kamran / "Basic VLSI Design"/ Prentice – Hall (India).-2015
3. Razavi, Behzad / "Design of Analog CMOS integrated circuits" / Tata McGraw-Hill.-2003
4. Weste, N.H.E. & Eshraghian, K. / "Principles of CMOS VLSI Design" / Pearson Education Asia-1993

Departmental Electives-I

Course Code: ECE – S501 Breakup: 3 1 0 4

Course Name: Power Electronics

Course Outcome:

CO1	Relate basic semiconductor physics to properties of power devices, and combine circuit mathematics and characteristics of linear and non-linear devices.
CO2	Describe basic operation and compare performance of various power semiconductor devices, passive components and switching circuits
CO3	Design and Analyse power converter circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.
CO4	Formulate and analyse a power electronic design at the system level and assess the performance.
CO5	Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.
CO6	Recognize the role power electronics play in the improvement of energy usage efficiency and the applications of power electronics in emerging areas.

Course Details:

UNIT I Power Semiconductor Devices:

Power semiconductor devices their symbols and static characteristics. Characteristics and specifications of switches, types of power electronic circuits. BJTO operation steady state and switch characteristics, switching limits. Operation and steady state characteristics of MOSFET and IGBT. Thyristor – Operation V- I characteristics, two transistor model, methods of turn-on Operation of GTO, MCT and TRIAC

UNIT II

Power Semiconductor Devices

Protection of devices. Series and parallel operation of thyristors, Commutation techniques of thyristor

DC-DC Converters:

Principles of step-down chopper, step down chopper with R-L load, Principle of step-up chopper, and operation with RL load, classification of choppers.

UNIT III

Phase Controlled Converters

Single phase half wave controlled, rectifier with resistive and inductive loads, effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters.

Performance Parameters, three phase half wave converters, three phase fully controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters. Resonant converters

UNIT IV

AC Voltage Controllers

Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads.

Three phase ac voltage controllers (various configurations and comparison), Single phase transformer tap changer. Cyclo-Converters, Basic principle of operation, single phase to single phase, three phase to single phase and three phase to three phase cyclo-converters, output voltage equation

UNIT V

Inverters

Single phase series resonant inverter, Single phase bridge inverters, Three phase bridge inverters

Voltage control of inverters, Harmonics reduction techniques, Single phase and three phase current source inverters.

Text Books:

1. M.H. Rashid,"Power Electronics: Circuits, Devices & Applications", Prentice Hall of India Ltd. 3rd Edition,2004.
2. M.D. Singh and K.B.Khanchandani, "Power Electronics" Tata MC Graw Hill, 2005

Reference Books:

1. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
2. A. Chakrabarti,rai & Co. "Fundamentals of Power Electronics & Drives" Dhanpat Rai.-2010
3. K.Hari Babu, "Power Electronics" Switch Publications-2004

Course Code: ECE – S502 Breakup: 3 1 0 4

Course Name: Microprocessor Based Instrumentation

Course Outcome:

CO1	understand the structure of a microprocessor.
CO2	Understand assembly language programming versus high-level programming.
CO3	Understand the definition of an embedded system.
CO4	Be familiar with the use of register pairs in the techniques of indexing.
CO5	Be familiar with how subroutines can be nested.
CO6	Understand how the Programmable Interval Timer (PIT) works.
CO7	Obtain a basic understanding of Direct Memory Access Controller.

Course Details:

Unit – 1
Introduction: review of Architecture & Assembly language programming of 8086, Memory Interfacing, data transfer techniques and their implementation.

Unit – 2
Common peripherals and their interfacing: single chip microcontrollers – 8051 family and 8086 architecture, instruction set and programming.

Unit – 3
Buses: types of buses IEEE 488, MULTI bus, MIL – STD – 1553 Bus contronix standard, serial bus standards.

Unit – 4
Interfacing I/O Devices: Interfacing of keyboards, display (using 8279), power devices, optical motor shaft encoders, ADCs & DACs to microcontrollers, microcontroller based scale.

Unit – 5
Process control Applications: Data Acquisition, temperature scanners, temperature controller, Flow control & level control, signature Analyzer using a logic analyzer for Trouble shooting.

Textbooks:

1. Intel data sheets
2. DV Hall/microprocessor and interfacing/TMH.3rd ed. 2017
3. B.P.Singh/advanced microprocessor and microcontrollers/new age. 3rd ed. 2008

Reference Books:

1. B.P.Singh/microprocessor Interfacing and application/New age International.2013
2. Richard A.cox/Technician's guide to programmable controller/Vikas publishing house.4th Ed.2000

Course Code: ECE – S503 **Breakup: 3 1 0 4**

Course Name: Multimedia Communication

Course Outcome:

CO1	Understanding the multimedia communications systems, application and basic principles.
CO2	Analysis of the multimedia streaming.
CO3	Performing and establishing multimedia communication terminals.
CO4	Presentation of multimedia communications.

Course Details:

Unit –1

The communication requirement associated with the different types of multimedia applications such as video telephony/teleconferencing, Electronic mail, interactive TV, Electronic commerce, Web TV.

Unit – 2

Multimedia information representation, Text and image compression, standards for multimedia communications.

Unit – 3&4

Digital communication basics, operation of different kinds of networks, The internet, Broadband ATM networks, Entertainment networks, high speed modems.

Unit – 5

New communication protocols for use with these networks to meet the requirements of multimedia application, transport protocols, application support functions, Internet applications, The world wide web (WWW).

Textbooks:

1. Fred Halsoll/Multimedia communications: Applications, Networks, protocols and standards/Pearson education, Asia.-2002
2. Jean Walrand & Pravin Varaiya/High performance communication networks/Harcourt Asia PTE Ltd.-2004

Reference Books:

1. Jarnes E. Shuman/Multimedia in action/Vikas Publishing house Pvt. Ltd.-2002

Course Code: ECE – S504 **Breakup: 3 1 0 4**

Course Name: T.V. Engineering

Course Outcome:

CO1	Acquire knowledge in Fundamentals of Television, Monochrome TV transmitter and receiver, Camera tubes and colour TV display tubes, Colour TV systems and advanced colour TV systems.
CO2	Identify the elements of Television, Monochrome TV transmitter and receiver, Camera tubes and colour TV display tubes, Colour TV systems and advanced colour TV systems.
CO3	Interpret the essentials of colour TV and various colour TV systems.
CO4	Acquire knowledge in fundamentals of television, Monochrome TV transmitter and receiver, Camera tubes and colour TV display tubes, Colour TV systems and advanced colour TV systems.
CO5	Compare different display tubes and various colour TV systems.

Course Details:

Unit – 1

Basic television principle

Introduction, audio and video transmission, scanning principle, TV broadcasting, system, transmission & reception, Aspect ratio, Resolution, Video bandwidth.

Composite Video Signal

Video signals, composite video signal, blanking signal, horizontal & vertical blanking and sync pulses, Colour synchronizing signal.

Unit –2

Television Cameras

Introduction, Image orthicon, Vidicon, plumbicon, characteristics of camera tubes, video processing of camera pick – up signal, comparison of camera tubes.

Unit – 3

TV Transmitter

Video modulation, vestigial sideband transmission, standard TV channels Characteristics, TV transmitter, TV standards.

Receiver

Introduction, Block diagram, Receiver controls, RF tuners, Video channel and picture tube, AGC and synchronization circuits, Deflection circuit (Horizontal and vertical), video detector, Sound section.

Unit – 4

Colour TV Principles

Introduction, compatibility, colour fundamentals, chromaticity diagram, colour picture tubes (Delta – gun, P.I.L, & trintron), purity and convergence.

Colour Signal Transmission and Reception

Introduction, modulation of colour difference signals, formation of chrominance signal, Introduction of NTSC, PAL and SECAM colour system.

Unit 5

Introduction to HDTV and digital TV system: TV displays LCD and Plasma.

Textbooks:

1. Dome: Television Principles - MGH.
2. Hutson G.H.: Television receiver theory – Arnolds press.-1966

Reference Books:

1. Television Engineering : R.R. Gulati – New age Int.-2014
2. M.Mandal : Modern television system – PHI

Course Code: ECE – S505 **Breakup: 3 1 0 4**

Course Name: Artificial Intelligence

Course outcomes (CO): At the end of the course, the student will be able to:

CO1	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
CO2	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.
CO3	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO4	Demonstrate proficiency-developing applications in an 'AI language', expert system shell, or data-mining tool.
CO5	Demonstrate proficiency in applying scientific method to models of machine learning, apply AI to solve global problems

 Local Gree  Regional Yellow  

National Blue Global Grey

Course Details:

Unit – 1
Introduction to Artificial Intelligence. Natural and artificial intelligence. Role of representation of knowledge, Description matching and goal reduction, exploiting natural constraints in problem solving, Exploiting alternative paths, Best paths.

Unit – 2
Reasoning, Logic and Theorem proving: Deductive and inductive reasoning. heuristic methods, proof byresolutions and constraint propagation, problem solving Para diagrams.

Unit – 3
Knowledge replacement: First order predicate calculus, Skolemlsation, Resolution principle, Unification nementic networks, frame, system value inheritance, introduction to prolog, Introduction to expert systems, application of expert system and various shells.

Unit – 4
Application of artificial intelligence methods in various disciplines: database management, computer aided.

Text Books and References:

1. S.J. Russell and P. Norvig , Artificial intelligence : A Modern Approach , Pearson; 3rd edition 2010
2. Elaine Rich and Kaven Knight – Artificial Intellegence McGraw Hill Education; 3rd edition, 2017
3. Introduction to Artificial Intelligence, Mariusz Flasiński, Springer, 1st ed. 2016
4. Introduction to Artificial Intelligence, Patterson, Pearson, 2015

Course Code: ECE – S506 **Breakup: 3 1 0 4**

Course Name: Advanced Semiconductor Devices

Course Outcome:

CO1	Ability to analyse and describe the PN junctions in semiconductor devices and the behaviour of various special purpose diodes.
CO2	Ability to understand and analyse the, structure, behaviour and various models of BJT, FET and MOSFET circuits.
CO3	Demonstrate the switching and amplification Application of the semiconductor devices.

Course Details:

Unit – 1

Bonding in solids ,Energy Bands, metal-semiconductor and ,Direct and Indirect semiconductors, Variation of energy bands with alloy composition, charge carriers in semiconductors, effective mass, Intrinsic and Extrinsic materials., The Fermi level & Fermi Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration Qualitative and Quantitative analysis, Temperature dependency of carrier concentration, conductivity and mobility, effects of temperature and doping on mobility, high field effects, the hall effects, Invariance of the Fermi level at equilibrium.

Unit – 2

Optical absorption, Luminescence, photoluminescence and electroluminescence, Direct and Indirect recombination, trapping, steady state carrier generation and Quasi Fermi levels, Diffusion and drift, diffusion length, diffusion and recombination. Gradient in the quasi-Fermi levels. Radiation in semiconductors, deep level transition, auger recombination, measurement of absorption and luminescence spectra.

Unit – 3

Fabrication of PN junctions, Different types of junction –grown junction, alloyed junction, diffused junction, Ion implanted junction, Epitaxial junctions. Current flow at junction, contact potential, space charge, carrier injection, Zener and Avalanche breakdowns, capacitance of junctions, depletion layer. switching diodes, rectifying and ohmic contacts, schottky diodes, varactor diodes.

Unit – 4

BJT-General characteristics, specification for switching transistors, thermal effects, kirk effects, transit effects, Webster Effect, Heterojunction Bipolar transistors.

Field effect transistors, the junction FET, V-I characteristics, MESFET, Basic operation, the ideal MOS capacitor,

threshold voltage, V-I characteristics of MOS gate oxides, MOSFET, output characteristics, transfer characteristics, Mobility Model, control of threshold voltage, power MOSFETS, CMOS structure

Unit – 5

Photodiode, solar cell, Phototransistor & Photomultipliers, LEDs, multilayers Heterojunction for LEDs, Semiconductor lasers, operating principles, Heterojunction laser, Distributed feedback lasers, Negative conductance microwave devices – Tunnel diode, IMPATT diode, Gunn diode, QWITT diode, TRAPATT

diode and circuit application. Power electronic devices- The pnpn diode, SCR, GTO, IGBT, operation and characteristics.

Textbooks:

1. B.G. Streetman/Solid State Devices /PHI. 6th Ed. 2005.
2. Millman & Halkias/Integrated Electronics/PHI.2nd Ed.-2017

Reference Books:

1. S.M. Sze/Semiconductor Devices: Physics and Technology/John Wiley-2007

Departmental Electives-II

Course Code: ECE – S507 Breakup: 3 1 0 4

Course Name: Information Theory and Coding

Course Outcome:

CO1	Expected Course Outcomes Upon completion of this course, the students will be able to:
CO2	Explain concept of Dependent & Independent Source, measure of information, Entropy, Rate of Information and Order of a source
CO3	Represent the information using Shannon Encoding, Shannon-Fano, Prefix and Huffman Encoding.
CO4	Model the continuous and discrete communication channels using input, output and
CO5	joint probabilities
CO6	Apply linear block codes for error detection and correction
CO7	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.

Course Details:

UNIT I

Source Coding: Introduction to Information Theory, Uncertainty and Information, Average Mutual Information and Entropy, Information Measures for Continuous Random Variables, Source Coding Theorem, Huffman Coding, The Lempel- Ziv Algorithm, Rate Distortion Function, Optimum Quantizer Design,

UNIT II

Channel Capacity and Coding: Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection of Codes.

UNITIII

Linear Block Codes for Error Correction: Introduction to Error Correcting Codes, Basic Definitions, Matrix Description of Linear Block Codes, Equivalent Codes, Parity Check Matrix, Decoding of a Linear Block Code, Syndrome Decoding, Error Probability after Coding (Probability of Error Correction), Perfect Codes, Hamming Codes, Optimal Linear Codes, Cyclic Codes, Introduction to Cyclic Codes, Polynomials, The Division Algorithm for Polynomials, A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Fire Code, Golay Codes, Cyclic Redundancy Check (CRC) Codes.

Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes
Reed-Solomon Codes, Implementation of Reed-Solomon Encoders and Decoders
Nested Codes,

UNIT IV

Convolutional Codes: Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Polynomial Description of Convolutional Codes (Analytical Representation), Notions for Convolutional Codes, The Generating Function, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Performance Bounds, Known Good Convolutional Codes, Turbo Codes, Turbo Decoding 792.14 C, Concluding Remarks 788.15 Po

UNIT V

Trellis Codes Modulation: Introduction to TCM, The concept of Coded Modulation, Mapping by Set Partitioning, Ungerboeck's TCM Design Rules, TCM Decoder, Performance Evaluation for AWGN Channel, Computation of dfree, TCM for Fading Channel.

Text Books:

1. Bose, Ranjan / "Information Theory, Coding & Cryptography" / Tata McGraw Hill /2008

Reference Books:

1. Van Lint**,** J.H./ "Introduction to Coding Theory" / Springer-Verlag Berlin and Heidelberg1998
2. Proakis, John G. / "Digital Communications" / McGraw Hill-2014
3. Sathyanarayana, P.S. / "Probability Information and Coding Theory"/ Dynaram Publications, Bangalore-2001
4. Gallager / "Information Theory and Reliable Communication"1991
5. Shulin & Costello/ "Error Correcting Codes" / Prentice Hall (India).-2004
6. Taub & Schilling / "Principles of Communication Systems" / Tata McGraw Hill-2nd Ed. 1996

Course Code: ECE – S508 Breakup: 3 1 0 4

Course Name: Satellite Communication and Radar

Course Outcome:

CO1	To understand the basics of satellite orbits.
CO2	To analyse the geostationary and non-geostationary orbits.
CO3	To acquire the knowledge about launching procedures.
CO4	To understand the satellite segment and earth segment.
CO5	To analyse the Satellite Uplink and Downlink.
CO6	To understand the G/T Ratio-Performance Impairments-System noise.
CO7	The Equipment Measurements on G/T, C/N, EIRP was discussed.
CO8	To understand the basics of Modulation and Multiplexing and Spread Spectrum communication.
CO9	Demonstrate the basic principle of RADAR System and Solve the RADAR Equation and to calculate Transmitter power.
CO10	Analyse the working principle of CW and Frequency Modulated Radar and Tracking Radar principle.

Course Details:

Unit-I

Introduction and Orbital Aspects:

Origin and Brief History, Orbital mechanics, Equation of Orbit, Location of Satellite in Orbit, Orbital Elements, Look Angle Determination, Elevation and Azimuthal Calculation, Orbital Perturbations, Geostationary Orbit, Launching Techniques.

Unit-II Space Craft:

Introduction to Space Craft Subsystems, Attitude and orbit control systems, Telemetry, Tracking and Command, Power Systems, Transponders, Space Craft Antennas.

Satellite link design: Basic transmission theory, system noise temperature and G/T ratio, Noise Figure and Noise Temperature, downlink & uplink system.

Unit-III

Modulation and multiple access techniques for satellite links:

S/N ratios for FM video transmission, digital transmission, digital modulation and demodulation, TDM. FDM/FM/FDMA, TDMA, DAMA and CDMA, Random Access. DBS: Introduction to analog DBS & Digital DBS.

Unit-IV

Radar Systems:

Basic Principles, Radar equation, Radar Performance Factors, Basic Pulsed Radar System, Radar Antenna and Scanning, Moving Target Indication, Overview o INSAT system & Intelsat system.

Textbooks:

1. Satellite Communications / Pratt, Bostian, Allnutt / John Wiley & Sons. -2003
2. Satellite Communications / Dennis Roddy / McGraw-Hill-July 2017

Reference Books:

3. Digital Satellite Communications/ Tri T. Ha./ McGraw-Hill.-2017
4. Electronics Communication systems/Kennedy./McGraw-Hill-5th Ed.2011

Course Code: ECE – S509 Breakup: 3 1 0 4

Course Name: Digital Image Processing

Course Outcome:

CO1	Review the fundamental concepts of a digital image processing system.
CO2	Analyse images in the frequency domain using various transforms.
CO3	Evaluate the techniques for image enhancement and image restoration.
CO4	Categorize various compression techniques.
CO5	Interpret Image compression standards.
CO6	Interpret image segmentation and representation techniques.

Course Details:

Unit I
Digitized Image & Its Properties: Basic Concepts, Image Digitization, Digital Image Properties
Data Structure for Image Analysis: Label of Image Data Representation, Traditional Image Data Structures, Hierarchical Data Structures

Unit II
Image Processing: Pixel Brightness, Transformation, Geometric Transformation, Local Preprocessing, Image Restoration
Segmentation: Thresholding, Edge Based Segmentation, Region Based Segmentation, Matching.
Shape Representation: Region Identification, Contour Base Representation, Region Based Shape Representation, Shape Classes

Unit III
Image Transforms: Two Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two Dimensional DFT, Cosine Transforms, Sine Transforms, Hudmard Transforms, KK Transforms, SVD Transforms
Image Enhancement: Point Operation, Histogram Modeling, Transform Operation

Unit IV
Image Data Compression: Image Data Properties, Discrete Image Transforms in Image Data Compression, Predictive Compression Methods, Vector Quantization, Hierarchical and Progressive Compression Methods, Comparison of Compression Methods, Coding, JPEG and MPEG Image Compression.

Unit V
3-D Vision, Geometry and Radiometry: 3-D Vision Tasks, Geometry for 3-D Vision, Radiometry and 3-D Vision, 3-D Model Based Vision, 2-D Based Representation of a 3-D Scheme.

Text Books:

1. Milan Sonya, Vaclav Hlavac & Roger Boyle / "Image Processing Analysis and Machine Vision"/ Vikas Publishing House 4th Edition,2015
2. A.K. Jain / "Digital Image Processing" / Pearson Education-1988

Reference Books:

1. Chanda, B. & Majumder, D. D. / "Digital Image Processing & Analysis" / Prentice Hall (India), 2017

Course Code: ECE – S510 Breakup: 3 1 0 4

Course Name: Artificial Neural Network

Course Outcome:

CO1	Understand the difference between biological neuron and artificial neuron
CO2	Understand the application areas of neural networks
CO3	Understand building blocks of Neural Networks.
CO4	Develop neural network models
CO5	Design and develop applications using neural networks.

Course Details:

Unit I

Fundamentals: Basic of neural science and artificial neural models, graph algorithm, interconnection and routing, placement and partitioning/parallel/computation/associative memory.

Unit II

Networks: perception, multilayer network, training feed forward networks, unsupervised and reinforcement learning,

Unit III

adaptive structure network, unsupervised competitive learning adaptive resonant network, hybrid learning, radial basis function network(RBF) and time delay network (TDNNs)

Unit IV

Fuzzy neural Networks: Fuzzy set a logic, ANN implementation.

Application: hardware and implementation concern, approach to solving hard problems, multi-target tracking, time service prediction, hard written digit recognition, image compression, visual process network.

Textbooks:

1. N.K.Bose & P.Liang/Neural Network fundamental with graph, algorithm and application/TMH-1996
2. Limin Fee/ Neural Network in compute Intelligence/TMH-2003

Reference Books:

3. Kosko/Neyral Network and fzzy System: A Dynamical system approach to machine intelligence/PHI-1994
4. Robert Schalkogs/Artificial Neural /TMH-2011

Course Code: ECE – S511 Breakup: 3 1 0 4

Course Name: Biomedical Instruments

Course Outcome:

CO1	Having understanding of different bioelectric potential and electrodes
CO2	Understanding cardiovascular system and its measurements
CO3	Understanding respiratory system and its measurement.
CO4	Having knowledge of diagnostic techniques, biotelemetry, Patient care and monitoring system.

Course Details:

Unit I

Introduction: The age of Biomedical Engineering, Development of Biomedical Instrumentation, Man–Instrumentation system, Components, Physiological system of the body, Problem encountered in measuring a living system.

Transducers & Electrodes: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications.

Unit II

Sources of Bioelectric potentials: Resting & Action potentials, propagation of active potential, The Bioelectric potentials-ECG, EEG, EMG, and Invoked Responses

Electrodes: Electrode theory, Bio potential Electrodes–Microelectrodes Body surface electrodes, Needle Electrodes, Biochemical Transducers, Reference electrodes, PH electrodes, Blood Gas electrodes.

Unit III

Cardiovascular Measurements: Electrocardiography – ECG amplifiers, Electrodes & leads, ECG recorders - Three channel, Vector Cardiographs, ECG system for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Care & Monitoring- Elements of Intensive Care monitoring, patient monitoring displays, Diagnosis, Calibration & Reparability of patient monitoring equipment, pacemakers & Defibrillators.

Unit IV

Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics- Spiro meter.

Respiratory Therapy equipment: Inhalators ventilators & Respirators, Humidifiers, Nebulizers & Aspirators.

Diagnostic Techniques: Ultrasonic Diagnosis Echocardiography, Echo Encephalography, Ophthalmic scans, X-Ray & Radio-isotope Instrumentation, Computerized Axial Tomography Scanners

Unit V

Bio Telemetry: The components of Biotelemetry System Implantable units, Telemetry for ECG measurements during exercise, for Emergency patient monitoring. Physiological Effects of Electric Current Safety of Medical Electronic Equipment, Shock hazards from Electrical equipment and prevention against them.

Text Books:

1. Cormwell / "Biomedical Instrumentation and Measurements"/ Prentice Hall (India).1980

Reference Books:

1. Khandpur R.S./ “Biomedical Instrumentation”/ Tata McGraw-Hill.2003
2. Tompkins / “Biomedical DSP: C Language Examples and Laboratory Experiments for the IBM PC”/ Prentice Hall (India).2015

Course Code: ECE – S512 **Breakup: 3 1 0 4**

Course Name: Advanced Microprocessor

Course Outcome:

CO1	Knowledge of Salient Features of 80386DX
CO2	Understanding of major hurdles of Pipelining-Pipelining
CO3	Understanding of Pentium Microprocessor
CO4	Knowledge of the different architecture and applications.
CO5	Understanding of 8051 Microcontroller

Course Details:

Unit-I

Progress from 80286 to 80486

Salient Features of 80386DX, Architecture and signal Description of 80386, Register Organization of 80386, Addressing Modes, Data Types of 80386, Real Address Mode of 80386, Protected Mode of 80386, Segmentation, Paging, Virtual 8086 Mode, Enhanced Instruction set of 80386, The co-processor 80387.

Unit-II

Pipelining & Cache

Introduction, the major hurdles of Pipelining-Pipelining Hazards, how is Pipelining implemented, Extending to the MIPS Pipeline to Hardle Multi Cycle Operation, MIPS R4000 Pipeline, MIPS R4300 Pipeline, Cross cutting Issues.

Introduction, Review of the ABC of Cache, Cache Performance, Reducing Cache Miss Penalty, Reducing Miss Rate, Reducing Cache Miss Penalty, Reducing Miss Rate, Reducing Cache Miss Penalty or Miss Rate by Parallelism, Reducing Hit Time.

Unit-III

An Introduction to the Pentium Microprocessor

Introduction, Real mode and Practical Mode Operation, The Software model of the Pentium, A Functional Description of the Pentium, Pentium Processor Registers, Pentium Data organization, Pentium Instruction Types, Pentium Addressing Modes, Interrupts.

Pentium Instruction [Part-1]

Introduction, Assembly language Programming, The Processor Flags, Data Transfer Instructions, String Instruction.

Pentium Instruction [Part-2]

Introduction, Arithmetic Instructions, Logical instructions, bit-manipulation instructions, program transfer and control instructions, process control instructions. How an assembler generates Machine Codes, The beauty of Relocatable Code.

Interrupt Processing: Introduction, Hardware and Software Interrupts, The Interrupt vector table, The Interrupt Processing Sequence, Multiple Interrupts, Special interrupts, Interrupt Service Routine.

Unit-IV

Multicore processor

Architecture and application, RISC architecture, CISC architecture, ARM architecture and application

Unit-V

An Introduction to Microcontroller 8051

Intel Family of 8-bit Microcontroller, Architecture of 8051, Signal Description of 8051, Register set, Important operational features of 8051, Memory and I/O Addressing, Interrupts, Instruction set.

Textbooks:

1. A.K Ray, Bhurchandi- "Advanced Microprocessors and Peripherals".2017
2. Antonakos- "The Pentium Microprocessor".1996
3. John Hennessy & David Patterson- "Computer architecture-A Quantitative Approach".2011

Reference Books:

1. DV Hall- "Microprocessor Interfacing"2005.
2. Brey, Barry B- "INTEL Microprocessor".2008
3. Liu and Gibson G.A.- "Microcomputer Systems: the 8086/8088 Family".

Course Code: ECE – S513 Breakup: 3 1 0 4

Course Name: Radar & Navigation

Course Outcome:

CO1	To become familiar with fundamentals of RADAR
CO2	To gain in-depth knowledge about the different types of RADAR and their operations
CO3	Need for signal detection in RADAR and various detection techniques
CO4	To become familiar with RADAR navigation techniques

Course Details:

Unit1
Nature of Radar
Radar block diagram & operation, Radar range performance & its equations, Minimum detectable signal, Cross-section of a target, PRF & Range ambiguity, Antenna parameters

Unit2
MTI & Doppler radar
Doppler effect, CW radar, FM CW, Delay line cancellers, Multiple or staggered, PRF, Non coherent MTI, Pulse Doppler Radar

Unit3
Scanning, Duplexers and Radar receivers
Sequential lobing, Conical Scanning, Monopulse Tracking RADAR, tracking with surveillance RADAR, Acquisition, Radar receiver, Display Duplexers

Unit4
Electronic Navigation
Introduction, loop antenna, loop Input circuits, Aural null detection finder, Goniometer, Adcock detection finder, VHF omni-directional range finder, The LF/MF four course radio range

Unit5
Navigation Systems and Clutter
VOR receiving equipment, Loran-A, DECCA navigation system, DME, TACAN, Surface clutters Radar equation, Sea clutter, Land clutter

Text Book:

1. Skolnik M. I. / "Introduction to Radar Systems"/ McGraw-Hill, 3rd Ed. 2002
2. Nagraja, N.S. / "Elements of Electronic Navigation"/ Tata McGraw Hill / 3rd Ed.2001

Reference Book:

1. Nathanson, Fred E. / "Radar an Overview Design Principles"/ Prentice–Hall (India)-2013
2. Toomay, J.C. / "Principles of Radar"/ Prentice–Hall (India)-2010