CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY
KANPUR

SYLLABUS

BACHELOR OF TECHNOLOGY
ELECTRONICS & COMMUNICATION ENGINEERING

SCHOOL OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SCHOOL OF ENGINEERING & TECHNOLOGY

Vision

- To excel in engineering education by nurturing technically proficient and ethically grounded professionals and entrepreneurs. The department aspires to empower students with innovative skills and a sense of social responsibility, enabling them to contribute meaningfully to global progress and drive positive transformation in society and the nation.

Mission

- To deliver affordable, high-quality education aligned with global academic standards, while embracing and serving a socially diverse community.
- To foster innovation and cultivate an entrepreneurial mindset through a dynamic learning and research environment.
- To practice and encourage high standards of professional ethics and accountability among students

Bachelor of Technology
(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.

GENERAL COURSE STRUCTURE & CREDIT DISTRIBUTION

➢ Semester-wise Course Structure

Course code	Definitions	Course code	Definitions
L	Lecture	HSMC	Humanities and Social Sciences including Management courses
T	Tutorial	EC	Program core courses
P	Practical	PE	Program Elective courses
C	Credits	OE	Open Elective courses
BSC	Basic Science Courses	LC	Laboratory course
ESC	Engineering Science Courses	MC	Mandatory courses
		AU	Audit Course

➢ **Structure of UG Program in Electronics and Communication Engineering (ECE):** The structure of UG program in Electronics and Communication Engineering (ECE) shall have essentially the following categories of courses with the breakup of credits as given:

S.No.	Category	Credit Breakup
1	Humanities and Social Sciences, including Management courses	19
2	Basic Science courses	31
3	Engineering Science courses including workshop, drawing, basics of electronics/electrical/mechanical/computer etc.	24
4	Professional core courses	65
5	Professional Elective courses relevant to chosen specialization/branch	15
6	Open subjects – Electives from other technical and /or emerging subjects	09
7	Project work, summer training and internship in industry or elsewhere	15
8	Mandatory Courses/Audit Courses [Environmental Sciences, Induction Program]	02
	Total	**180**

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES COURSES [HSM]

(i) Number of Humanities & Social Science Courses: 6
(ii) Credits: 19

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	UHV S101	Universal Human Values-I (SIP)	I	-	-	-	0
2	HSS S101	Professional Communication	II	3	1	0	4
3	HSS S301	Engineering Economics	VI	3	1	0	4
4	UHV S201	Universal Human Values-II	IV	2	1	0	3
5	HSS S201	Communication Practicum	IV	3	1	0	4
6	HSS S302	Industrial Management	V	3	1	0	4
						Total Credits	**19**

BASIC SCIENCE COURSE [BSC]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	MTH S101	Mathematics–I	I	3	1	0	4
2	PHY S101	Physics –I	I	3	1	3	5
3	CHM S101	Chemistry–I	I	3	0	3	5
4	MTH S102	Mathematics–II	II	3	1	0	4
5	PHY S102	Physics–II	II	3	1	3	5
6	MTH S201	Mathematics-III	III	3	1	0	4
7	MTH S301	Discrete Mathematics	IV	3	1	0	4
						Total Credits	**31**

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ENGINEERING SCIENCE COURSE [ESC]

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	TCA S101	Engineering Drawing	I	0	2	4	5
2	ESC S101	Basic Electrical &Electronics Engineering	I	3	1	3	5
3	ISC S101	Programming & Computing (C & UNIX)	II	3	0	3	5
4	TCA S102	Workshop Practice & IDEA Lab	II	1	1	3	5
5	ESC S203	Introduction to Machine Learning	IV	3	1	0	4
Total Credits							**24**

PROGRAM CORE COURSES

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	ECE S201	Analog Electronics	III	3	1	3	5
2	ECE S202	Digital Electronics & Logic Design	III	3	1	3	5
3	ECE S203	Electromagnetic Theory	III	3	0	0	3
4	ECE S204	Network Analysis and Synthesis	III	3	0	0	3
5	ECE S205	Analog Integrated Circuit	IV	3	0	3	5
6	ECE S206	Microprocessors and Microcontrollers	IV	3	0	3	5
7	ECE S301	Analog and Digital Communication	V	3	0	3	5
8	ECE S302	Instrumentation and Measurements	V	3	0	3	5
9	ECE S303	Control System	V	3	0	0	3
10	ECE S304	Power Electronics	V	3	0	0	3
11	ECE S305	Signals & Systems	V	3	1	0	4
12	ECE S306	Digital Signal Processing	VI	3	0	3	5
13	ECE S307	Fibre Optics Communication	VI	3	0	3	5
14	ECE S308	VLSI Design and Technology	VI	3	1	0	4
15	ECE S401	Wireless and Mobile Communication	VII	3	0	3	5
Total Credits							**65**

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PROJECT/ SUMMER TRAINING/ INTERNSHIP

S. No	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	SST S201	Summer Internship - I	III	0	0	3	2
2	SST S301	Summer Internship - II	V	0	0	3	2
3	SST S301	Summer Training	VII	0	0	3	2
4	PRT S401	Project - I	VII	0	0	6	4
5	PRT S402	Project - II	VIII	0	0	6	5
						Total Credits	**15**

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MANDATORY/AUDIT COURSES

S. N	Code No.	Course Title	Semester	Hours per week			Total Credits
				Lecture	Tutorial	Practical	
1	EVS S201	Environmental Science	III	2	0	0	2
			Total Credits				**02**

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PROGRAM ELECTIVE (PE) COURSES

S. N.	Course Code	Course Title	SEM	L	T	P	Credits
Program Elective (PE) - I							
1	ECE S501	Data Communication and Computer Networks	VI	3	0	0	3
2	ECE S502	Advanced Engineering Materials	VI	3	0	0	3
3	ECE S503	Microwave Engineering	VI	3	0	0	3
4	ECE S504	Data Structures and Algorithms Design	VI	3	0	0	3
5	ECE S505	Introduction to MEMS	VI	3	0	0	3
6	ECE S506	Adaptive Signal Processing	VI	3	0	0	3
Program Elective (PE)- II							
7	ECE S507	Antennas and Wave Propagation	VII	3	0	0	3
8	ECE S508	Satellite Communication	VII	3	0	0	3
9	ECE S509	Renewable Energy Systems	VII	3	0	0	3
10	ECE S510	Microprocessor-based Instrumentation System	VII	3	0	0	3
11	ECE S511	Mixed Signal Design	VII	3	0	0	3
12	ECE S512	High Speed Electronics	VII	3	0	0	3
Program Elective (PE) - III & IV							
13	ECE S513	Introduction to Internet of Things	VIII	3	0	0	3
14	ECE S514	Advanced Microprocessor	VIII	3	0	0	3
15	ECE S515	Advanced Semiconductor Devices	VIII	3	0	0	3
16	ECE S516	Advanced Mobile Communications	VIII	3	0	0	3
17	ECE S517	Bio-Medical Electronics	VIII	3	0	0	3
18	ECE S518	Nano-electronics	VIII	3	0	0	3

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Open Electives (OE) Courses from ECE Department/MOOCs:

Sr. No.	Course Code	Course Title	SEM	L	T	P	Credits
Open Electives (OE)-I							
1	ECE S306	Digital Signal Processing	VI	3	0	3	5
2	ECE S308	VLSI Design and Technology	VI	3	1	0	4
3	ECE S519	Wireless Sensor Network	VI	3	0	0	3
Open Electives (OE) - II							
4	ECE S401	Wireless and Mobile Communication	VII	3	0	3	5
5	ECE S520	Information Coding	VII	3	0	0	3
6	ECE S521	Artificial Neural Network	VII	3	0	0	3
Open Electives (OE)-III							
7	ECE S522	Embedded Systems	VIII	3	0	2	5
8	ECE S523	Cyber Security	VIII	3	0	0	3
9	ECE S524	Multimedia Communication	VIII	3	0	0	3
10	ECE S525	Digital Image Processing	VIII	3	0	0	3
11.	ECE S526	IoT with Arduino, ESP, and Raspberry Pi	VIII	3	0	0	3

NOTE- The institute may offer suitable additional electives based on the expertise available or in Online Mode from SWAYAM.

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Bridge Courses for exit

- 2- Months internship for 6-Credits

  OR

- **Two courses mentioned below of 6 credits**.

A. After First Year:

Any two suitable skill-based courses to qualify for Certification.

1) Consumer Electronic/Radio Engineering /Digital Electronics (Any one course)
2) Electronics Servicing and Maintenance

B. After Second Year:

Any two suitable skill-based courses to qualify for Diploma.

1) Data Communication and Networking
2) Electronics Servicing and Maintenance

C. After Third Year:

Any two suitable skill-based courses to qualify for B. Voc.

1) Advanced Mobile Communication
2) Cyber Security

Minor Degree (MD) from Other Department

a) For holistic development of the students and as per NEP S2020 and AICTE guideline, the students may earn additional 18 S20 credits through the minor degree courses offered by different departments of the University from Semester IV to VIII. The Minor Degrees offered by different departments will be the state-of-the-art courses that make the student competent in his/her discipline to meet the additional global challenges.

b) The choice of MD will be optional in the sense that if the student does not opt for MD, he/she can complete his/her B.Tech. program with a minimum of 180 credits. However, if a student opts for the additional 18 - 20 credits through minor degree courses, he/she will get B.Tech. Degree with Minor in 1) VLSI Design & Technology. 2) Internet of Things and Embedded Systems. 3) Electronics and Communication Engineering.

In the present credit structure, a student will have to choose inter-minor courses in total, and an additional 18 - 20 credits can be earned during the entire period of the B.Tech. program. If a student is not willing to opt for a minor degree, he/she may opt for intra minor courses to complete the overall 180 credits.

Minor Degree (MD) in VLSI Design & Technology
(For Other Departments)

S. No.	Course Code	Course Title	SEM	L	T	P	Credits
1	ECE S201	Analog Electronics	III	3	1	3	5
2	ECE S202	Digital Electronics & Logic Design	III	3	1	3	5
3	ECE S502	Advanced Engineering Materials	VI	3	0	0	3
4	ECE S308	VLSI Design and Technology	VI	3	1	0	4
5	ECE S515	Advanced Semiconductor Devices	VIII	3	0	0	3
Total				**12**	**3**	**6**	**20**

Minor Degree (MD) in "Internet of Things and Embedded Systems"

(For Other Departments)

S. No.	Course Code	Course Title	SEM	L	T	P	Credits
1	ECE S513	Introduction to Internet of Things	VIII	3	0	0	3
2	ECE S523	Cyber Security	VIII	3	0	0	3
3	ECE S501	Data Communication and Computer Networks	VI	3	0	0	3
4	ECE S522	Embedded Systems	VIII	3	0	2	5
5	ECE S526	IoT with Arduino, ESP, and Raspberry Pi	VIII	3	0	2	5
Total				**12**	**0**	**4**	**19**

Minor Degree (MD) in "Electronics & Communication Engineering"

(For Other Departments)

S. No.	Course Code	Course Title	SEM	L	T	P	Credits
1	ECE S205	Analog Integrated Circuit	IV	3	0	3	5
2	ECE S301	Analog and Digital Communication	V	3	0	3	5
3	ECE S306	Digital Signal Processing	VI	3	0	3	5
OR (ECE S306 / ECE S307)							
4	ECE S307	Fibre Optics Communication	VI	3	0	3	5
5	ECE S401	Wireless and Mobile Communication	VII	3	0	3	5
Total				**12**	**0**	**12**	**20**

B.Tech. (ECE) Course Structure

1st Year/ Semester- I

S. No.	Course Code	Course Title	L	T	P	Credits
1	MTH S101	Mathematics – I	3	1	0	4
2	PHY S101	Physics – I	3	1	3	5
3	CHM S101	Chemistry – I	3	0	3	5
4	TCA S101	Engineering Drawing	2	1	3	5
5	ESC S101	Basic Electrical & Electronics Engineering	3	1	3	5
6	UHV S101	Universal Human Values - I (SIP)				0
		Total	**12**	**05**	**13**	**24**

1st Year/ Semester II

S. No.	Course Code	Course Title	L	T	P	Credits
1	MTH S102	Mathematics – II	3	1	0	4
2	PHY S102	Physics – II	3	1	3	5
3	HSS S101	Professional Communication	3	1	0	4
4	ISC S101	Programming & Computing (C & UNIX)	3	0	3	5
5	TCA S102	Workshop Practice & IDEA Lab	2	1	3	5
		Total	**13**	**04**	**09**	**23**

2nd Year/ Semester III

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S201	Analog Electronics	3	1	3	5
2	ECE S202	Digital Electronics & Logic Design	3	1	3	5
3	ECE S203	Electromagnetic Theory	3	0	0	3
4	ECE S204	Network Analysis and Synthesis	3	0	0	3
5	MTH S201	Mathematics - III	3	1	0	4
6	SST S201	Summer Internship - I	0	0	3	2
7	EVS S201	Environmental Science	2	0	0	2
		Total	**17**	**03**	**09**	**24**

2nd Year/ Semester IV

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S205	Analog Integrated Circuit	3	0	3	5
2	ECE S206	Microprocessors and Microcontrollers	3	0	3	5
3	ESC S203	Introduction to Machine Learning	3	1	0	4
4	MTH S301	Discrete Mathematics	3	1	0	4
5	HSS S201	Communication Practicum	3	1	0	4
6	UHV S201	Universal Human Values - II	2	1	0	3
		Total	**17**	**03**	**06**	**25**

3rd Year/ Semester V

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S301	Analog and Digital Communication	3	0	3	5
2	ECE S302	Instrumentation and Measurements	3	0	3	5
3	ECE S303	Control System	3	0	0	3
4	ECE S304	Power Electronics	3	0	0	3
5	ECE S305	Signals and Systems	3	1	0	4
6	HSS S302	Industrial Management	3	1	0	4
7	SST S301	Summer Internship - II	0	0	3	2
		Total	**18**	**01**	**09**	**26**

3rd Year/ Semester VI

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S306	Digital Signal Processing	3	0	3	5
2	ECE S307	Fibre Optics Communication	3	0	3	5
3	ECE S308	VLSI Design and Technology	3	1	0	4
4	HSS S301	Engineering Economics	3	1	0	4
5	ECE S5XX	Program Electives- I	3	0	0	3
6	*	Open Electives - I	3	0	0	3
		Total	**18**	**01**	**09**	**24**

4th Year/ Semester VII

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S401	Wireless and Mobile Communication	3	0	3	5
2	ECE S5XX	Program Electives – II	3	0	0	3
3	ECE S5XX	Program Electives – III	3	0	0	3
4	*	Open Electives – II	3	0	0	3
5	SST S401	Summer Training	0	0	3	2
6	PRT S401	Project - I	0	0	6	4
		Total	**12**	**00**	**12**	**20**

4th Year/ Semester VIII

S. No.	Course Code	Course Title	L	T	P	Credits
1	ECE S5XX	Program Electives - IV	3	0	0	3
2	ECE S5XX	Program Electives - V	3	0	0	3
3	*	Open Electives – III	3	0	0	3
4	PRT S402	Project - II	0	0	6	5
		Total	**09**	**00**	**18**	**14**

***** The course code (open-elective) depends on the choice of course selected by the student from another department or MOOCs.

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

Course Outcome: 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, nth 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 Edu, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

References:

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.
4. Electronic devices and circuit Theory 11th edition by Robert L. Bolysted and Louis Nashel

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

Course Outcome: 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:

Unit- I 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- II 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- III 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- IV 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- V 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, Cambridge University 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 & Problems of Theoretical Mechanics by M. R. Spiegel, Schaum'sOutline 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 Edu (India) Pvt ,2010.
5. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press, 2018.

Laboratory

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: CHM – S101		Breakup: 3–0 – 3– 5
Course Name: **Chemistry - I**		

Course Outcome: 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 help 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 onding 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, DhanpatRai 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-nitro acetanilide.
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.

11. To study the kinetics of first order reaction (methyl acetate hydrolysis catalysed by o.5 N HCl solution).

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, Cambridge Uni, 2nd ed, 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 & Problems of Theoretical Mechanics by M. R. Spiegel, Schaum'sOutline 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: ESC-S101		Breakup: 3 -1 -3 -5
Course Name: Basic Electrical & Electronics Engineering		

Course Outcome: 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:

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, Electrical measurement – measurement of voltage, current, power & energy, voltmeters& ammeter, wattmeter, energy meter, three phase power measurement, electronics instrument–multimeter, CRO (analog & digital),

Unit –II Network Theory: Introduction to network terminology, Kirchhoff's Law, KVL and KCL, circuit theory concept – mesh & nodal analysis. Network theorems – Thevenin's, Norton, maximum power transfer theorem, star delta transformation,

Unit – III Introduction to transformer, Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency. DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features and applications.

Unit – IV 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. PN Junction Diode & its applications: Half wave and Full Wave Rectifier, bridge Rectifier.

Unit – V Introduction to Bipolar Junction Transistor, Transistor construction, and its various mode of operations, configurations-CE, CB and CC with its input / output characteristics. Transistor biasing load line and Operating point.
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. ChandPublishing.2020

References:

5. S. K. Bhattcharya, “Basic Electrical and Electronics Engineering”, Pearson, 2012.
6. Vincent Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall of India Private Limited, 2nd Edition, 2003.
7. David Bell, “Electronic Devices and Circuits”, 5th Edition, Oxford University Press, 2008.
8. Electronic devices and circuit Theory 11th edition by Robert L. Bolysted and Louis Nashel

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

Course Outcome: 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 Outcome: 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, magneto statics, electromagnetic induction, Maxwell's equations and electromagnetic waves
CO4	Apply the concepts of physics in the engineering courses

Course Details:

Unit I 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 multi poles, potential energy of a dipole placed in external electric field, Laplace's equation, Poisson's equation.

Unit II Magneto statics, 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 III 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 IV 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 V 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:

2. A textbook of Optics by Subramanian, Brijlal and Avadhanulu, Schand; 23rd Rev. Edition. 2006.
3. Classical electrodynamics by J. D. Jackson, Wiley, 3rd edition, 1998.
4. Concept of Modern Physics by Aurthur Beiser, McGraw-Hill Education,6th Edition 2021.
5. 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: HSS-S101		Breakup: 3–1 – 0 – 4
Course Name: **Professional Communication**		

Course Outcome: 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.
2. Barun K. Mitra, Effective Technical Communication, Oxford Univ. Press, 2006
3. R.C. Sharma & Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill & Co. Ltd., 2002.

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. 2nd, 2009.
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: ISC – S101		Breakup: 3–0 – 3 – 5
Course Name: **Programming & Computing (C & UNIX)**		

Course Outcome: 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, McGraw 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- 3- 5
Course Name: Workshop Practice & IDEA Lab		

Course Outcome: At the end of the course, the student will be able to

CO 1	Understand the design and applications of different machine tools and their operations
CO 2	Gain basic knowledge of casting processes and their applications
CO 3	Recognize the different types metal forming process and their operations
CO 4	Understand and appreciate the basic fabrication processes such as welding
CO 5	Have knowledge about modern trends in manufacturing, unconventional machining processes and automation
CO6	Demonstrate the ability to design, prototype, and test electronic systems using measurement instruments, embedded platforms, and fabrication techniques

Course Details:
Historical perspectives and Classification of Manufacturing processes

Unit – I 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.

Unit –II 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

Unit – III 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;

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

Unit – V 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

Unit-VI IDEA Lab: Familiarization and use of basic electronic measurement instruments-DSO, Signal and function generator. Bench power supply. Circuit prototyping, 3D printing, Arduino programming

Workshop Practice

Course Details: Laboratory Activities

1.	Foundry (1turn)	**4.**	M/C Shop (4 Turns)
2.	Welding (3 turns) i. Gas Welding (1turn) ii. Arc Welding (2 urns)	**5.**	Fitting & Sheet Metal Work (1 turn+1turn)
		6.	Carpentry Shop (1turn)
3.	i. Lap Joint (1 turn), ii. Butt Joint (1 turn)	**7.**	Black-smithy Shop (1turn)

8.	Machining of 3D geometry on soft material such as soft wood or modelling wax.
9.	2D profile cutting on plywood /MDF (6-12 mm) for press fit designs.
10.	Schematic and PCB layout design of a suitable circuit and fabrication.
11.	Embedded programming using Arduino and/or Raspberry Pi.
12.	Discussion and implementation of a mini project.

Text Books:

1. Chapman, W A J & Arnold, E "Workshop Technology,1972; vol. I, II&III" Viva Low Priced Edition 2002.
2. Raghuwanshi,B S "Workshop Technology ,2015; vol. I&II" Dhanpat Rai& Sons.

References:

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing.
2. Chaudhary, Hajra "Elements of Workshop Technology, 2008; vol. I&II" Media Promoters & Publishers.
3. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.
4. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633

Course Code: ECE –S201		Breakup: 3-1-3- 5
Course Name: Analog Electronics		

Course Outcome: At the end of the course, the student will be able to

CO1	To develop a comprehensive understanding of various special-purpose semiconductor diodes, including their construction, characteristics, and practical applications.
CO2	To enable students to analyze and design BJT-based amplifier circuits using small signal models and h-parameters.
CO3	To impart knowledge on the construction, operation, and characteristics of JFETs, and to compare their performance with BJTs in amplifier configurations.
CO4	To provide an in-depth understanding of the physical structure, modes of operation, and current-voltage characteristics of MOSFETs in both enhancement and depletion modes.
CO5	To introduce the concept of multi-stage amplification, explain different coupling methods, and analyze cascaded amplifier configurations.

Course Details:

UNIT-I Special Diodes: Review of PN Junction, Breakdown Mechanisms in Semiconductor Diodes, Zener Diode, Zener Diode as a regulator, - Tunnel Diode, Varactor Diode, Semiconductor Photo Diode, Light Emitting Diode

UNIT-II Bipolar Junction Transistor and UJT: Review of BJT, Transistor as an Amplifier, analysis of generalized amplifier; small signal, low frequency transistor amplifier, Graphical analysis of CE amplifier, Voltage gain, current gain and input-output impedance calculation, Transistor, Hybrid Model, Determination of h-parameters, measurement of h parameters, Analysis of transistor amplifier circuit using h parameters.

UNIT-III Junction Field Effect Transistor: The Junction Field Effect Transistor (Construction, principle of operation) Pinch-off Voltage Volt-Ampere characteristics, Practical FET Structure, FET parameters, FET as Voltage Variable Resistor, FET Amplifiers: FET Common Source Amplifier, Common Drain Amplifier, Generalized FET Amplifier, Comparison of BJT and FET amplifiers.

UNIT-IV MOSFET: Structure and physical operation of MOSFET, MOSFET Characteristics in Enhancement and Depletion modes, Current voltage relationship in the saturation region and non-saturation region

UNIT-V Multi Stage Amplifiers: Need for multistage amplification; Classification of amplifiers, Methods of coupling - RC coupled amplifier, transformer coupled amplifier, Direct coupled Amplifier, Cascaded transistor amplifier and its analysis, High input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier.

Textbooks

1. Boylestad & Nashelsky – Electronic Devices and Circuit Theory 11th Edition (2016); Latest Reprint, Pearson.
2. Sedra & Smith – Microelectronic Circuits,8th Edition (2020), Oxford University Press
3. Millman & Halkias – Integrated Electronics: Analog and Digital Circuits and Systems, Reprint 2021, McGraw-Hill Education
4. Salivahanan & Kumar – Electronic Devices and Circuits, Latest Reprint 2022, McGraw-Hill Education
5. Rashid – Microelectronic Circuits: Analysis and Design,3rd Edition (2017), Reprint 2021, Cengage
6. Millman & Grabel – Microelectronics2nd Edition (Reprint 2022), McGraw-Hill
7. David A. Bell – Electronic Devices and Circuits5th Edition (Latest Reprint 2020) Oxford University Press.

Course Code: ECE S202		Breakup: 3 1 3 5
Course Name: Digital Electronics & Logic Design		

Course Outcome: At the end of the course, the student will be able to

CO1	At the end of the course the student should be able to examine the structure of number systems and perform the conversion among different number systems.
CO2	To understand the Digital Logic Family. Illustrate reduction of logical expressions using Boolean algebra, k-map and implement the functions using logic gates. Realize combinational circuits for given application.
CO3	Design and analyses synchronous and asynchronous sequential circuits using flip-flops.
CO4	To analyze different types of multivibrators and to study static and dynamic RAMs, ROM, EPROM, and EEPROM.
CO5	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.

Textbooks:

1. Morris Mano, “Digital Design” PHI
2. “Digital Electronics”, Bignill & Donovan.
3. “Digital Integrated Circuit” A.K.Gautam-Katson Publication.

References:

1. Taub and Schilling “Digital Integrated Electronics”,TMH
2. Bartee , Thomas C. / “Fundamentals of Digital Computers”/ Tata McGraw-Hill
3. Gopalan, K. “Gopal” / “Introduction To Digital Microelectronic Circuits” / Tata McGraw-Hill
4. Millman, Jocob & Taub, Herbert / “Pulse, Digital & Switching Waveforms” / Tata McGraw-Hi
5. Malvino, A.P. & Leach, Donald P. / “Digital Principles & Applications” / Tata McGraw-Hill

Course Code: ECE S203		Breakup: 3 0 0 3
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, poynting 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 Electrostatic: Vector analysis: Vector algebra, Coordinate system and Transformation, Vector calculus. Electrostatic Fields: Coulomb's law and field intensity, Electric field due to continuous charge distributions, Electric Flux density, Gauss's Law, Application of Gauss's law, Electric Potential, relationship between E and V, An electric dipole and flux lines, Energy density in Electrostatic Field. Electric Field in Material Space: Convection and conduction current, Polarization in Dielectric, Continuity Equation and Relaxation time, Boundary Conditions. Electrostatic boundary value problems: Poisson's and laplace's equations, Uniqueness theorem, Resistance and capacitance, Method of images

Unit-II Magnetostatic Biot-Savart's law, Ampere Circuital Law, Application of Ampere's Circuital law, Magnetic Flux density, Magnetic scalar and vector potentials, Force due to magnetic fields, Magnetic torque and moment, a Magnetic Dipole, Magnetization in Material, Classification of Magnetic material, Magnetic boundary conditions, Inductor and inductances, Magnetic Energy, Magnetic circuits.

Unit-III Maxwell's Equation and Electromagnetic Waves Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equation. Electromagnetic wave, Wave propagation in lossy dielectric, Plane waves in Lossless Dielectrics, Free Space and Good conductor, Power and the Poynting vector, Reflection of a plane wave at normal incidence, reflection of plane waves at oblique incidence

Unit-IV Transmission lines Transmission line parameters, Transmission line equations, Input impedance, SWR and Power, Smith chart, Applications

Unit-V Waveguides Parallel Plate Waveguide, TE mode in parallel plate waveguide, TM mode in parallel plate waveguide, TEM mode in parallel plate waveguide, Rectangular Waveguide, TE mode in rectangular wave guide, TM mode in rectangular waveguide, Power transmission and attenuation.

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" / McGraw-Hill's, 1961
2. Collin, R. E. / "Antennas and Radio Wave Propagation"/ TataMcGraw-Hill, 1985.
3. Pramanik, Ashutosh/"Electromagnetism, Theory &Applications"/Prentice Hall India ,2014.
4. Schaum's Outlines / "Electromagnetics" / Tata McGraw-Hill / 2ndEd, *1994.*
5. Kraus,Fleisch/"ElectromagneticswithApplications"/TataMcGraw-Hill, 2010..
6. Sadiku,MatthewN.O./"ElementsofElectromagnetics"/OxfordUniversityPress,2007

Course Code: ECE S204		Breakup: 3 0 0 3
Course Name: Network Analysis and Synthesis		

Course Outcome: At the end of the course, the student will be able to

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 filters

Course Details:

Unit-I Graph Theory: Importance of Graph Theory in Network Analysis, Graph of a network, Definitions, planar & Non-Planar Graphs, Isomorphism, Tree, Co Tree, Link, basic loop and basic cutset, Incidence matrix, Cut set matrix, Tie set matrix, Duality, Loop and Nodal methods of analysis.

Unit-II Transient Circuit Analysis: Natural response and forced response, Transient response and steady state response for arbitrary inputs (DC and AC), Evaluation of time response both through classical and Laplace methods.

Unit-III Network Functions: Concept of complex frequency, Transform impedances network functions of one port and two port networks, Concept of poles and zeros, Properties of driving point and transfer functions.

Unit-IV Two Port Networks: Characterization of LTI two port networks; Z, Y, ABCD, A'B'C'D', g and h parameters, Reciprocity and symmetry, Inter-relationships between the parameters, Inter-connections of two port networks, Ladder and Lattice networks: T & Π representation, terminated two Port networks, Image Impedance.

Unit-V Network Synthesis: Positive real function; definition and properties, Properties of LC, RC and RL driving point functions, Synthesis of LC, RC and RL driving point immittance functions using Foster and Cauer first and second forms. **Filters** Image parameters and characteristics impedance, Passive and active filter fundamentals, Low pass filters, High pass (constant K type) filters, Introduction to active filters.

Text Books:

1. ME Van Valkenburg, "Network Analysis", Prentice Hall of India.
2. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw Hill.
3. D. Roy Choudhary, "Networks and Systems", Wiley Eastern Ltd.
4. CL Wadhwa, "Network Analysis and Synthesis", New Age International Publishers.
5. A. Chakrabarti, "Circuit Theory", Dhanpat Rai & Co.

Reference Books:

1. Hayt, Kimmerly, Durbin, "Engineering Circuit Analysis", McGraw Hill.
2. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach", McGraw Hill.
3. ME Van Valkenburg, "An Introduction to Modern Network Synthesis", Wiley Eastern Ltd.

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

Course Outcome: 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: EVS-S201		Breakup: 2–0 – 0–2
Course Name: **Environmental Science**		

Course Outcome: 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: ECE S205		Breakup: 3 0 3 5
Course Name: Analog Integrated Circuits		

Course Outcome: At the end of the course, the student will be able to

CO1	To develop a comprehensive understanding of advantages of negative feedback and various topologies feedback amplifiers.
CO2	To enable students to analyze and Power Amplifiers and classifications of output stages with limitation of Heat sink and Temperature Effects.
CO3	Design sinusoidal and non-sinusoidal oscillators and to impart knowledge on Basic IC Op-Amp Fundamentals.
CO4	Understand the functioning of OP-AMP and design OP-AMP based circuits.
CO5	To apply the knowledge of ADC and DAC in different systems and Design simple wave shaping circuits.

UNIT-I Feedback amplifiers and topologies: Principles of feedback in amplifiers, advantages of negative feedback. Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.

UNIT-II Power Amplifiers: Significance of power amplifiers, Classification of Output Stages: Class A, Class B, Class AB, Class C amplifier and Push-Pull Configuration, Power dissipation and Output Power conversion efficiency. Power BJTs and MOS Power Transistors. Junction Temperature, Thermal resistance, Transistor case and Heat sink.: Structure, Characteristics, Temperature Effects.

UNIT-III Oscillators and Basic IC Op-Amp Fundamentals: Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitt, Clapp etc.), non-sinusoidal oscillators.

Current mirror, active load, level shifter, output stage; ac and dc characteristics. Basic building blocks of OP – AMPS.

UNIT-IV OP-AMP applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Low pass, high pass, band pass and band stop, design guidelines.

UNIT-V Data Converters and wave shaping circuits: DAC/ADC, IC timer (555) applications, Monostable and Astable operation. Ramp Generator: Triangle generator, Saw-tooth generator

Text book:

1-Millman & Halkias/Integrated Electronics/TMH, Analog and Digital Circuit and Systems 2nd Edition 2017.

2- Shail Jain & D.R. Choudhary/Linear Integrated Circuit/PHI,4th Ed.

3-Sedra Smith Microelectronics / Oxford Universities Press.

4- Gayakwad / OPAmps and Linear Integrated circuits / PHI. Fourth Edition.

References:

1. C.S. Soclof / Application of analog Integratorcircuits / PHI.2011

2. Boylstad & Neshlshky/Electronics Devices &Circuits/PHI, (11th Edition), 2017

Course Code: ECE S206		Breakup: 3 0 3 5
Course Name: Microprocessors and Microcontrollers		

Course Outcomes: - At the end of the course, students will develop ability to define.

CO1	The history of microprocessors, describe the architectures of 8085 and 8086 microprocessors
CO2	Draw timing diagram. Write programs using 8085 and 8086.
CO3	Distinguish between the different modules of operation of microprocessors.
CO4	Interface peripherals to Microprocessor. Interfacing of memory with Microprocessor.
CO5	Architecture of Microcontroller & 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: SignalDescriptionofpinsof8086and8088, Clock generation, Address and data bus Demultiplexing, 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 / 8085Microprocessor /Penram International Publishing / 6thEd,2013
3. Kenneth J. Ayala / The 8051 Microcontroller / Penram InternationalPublishing.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) /9thEd. June 2018

Course Code- ESC S203		Breakup: 3 1 0 4
Course Name: Introduction to Machine Learning		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand the fundamental concepts of machine learning and its various paradigms.
CO2	Identify and describe different supervised, unsupervised, and reinforcement learning techniques.
CO3	Apply suitable machine learning algorithms to real-world datasets and evaluate their performance.
CO4	Analyze and compare different models using appropriate metrics such as accuracy, precision, recall, etc.
CO5	Design and implement machine learning solutions using libraries such as Scikit-learn or Tensor Flow.
CO6	Interpret the results of learning algorithms and draw conclusions for decision-making.

Course Details:

UNIT-1 Introduction: Objective, scope and outcome of the course, Preliminaries, what is machine learning; varieties of machine learning, learning input/output functions, bia, sample application.

UNIT-2. Boolean functions and their classes, CNF, DNF, decision lists. Version spaces for learning, version graphs, learning search of a version space, candidate elimination methods.

UNIT-3 Neural Networks, threshold logic units, linear machines, networks of threshold learning units, Training of feed forward networks by back propagations, neural networks vs. knowledge-based systems.

UNIT-4 Statistical Learning, background and general method, learning belief networks, nearest neighbor. Decision-trees, supervised learning of uni-variance decision trees, network equivalent of decision trees, overfitting and evaluation. Inductive Logic Programming, notation and definitions, introducing recursive programs, inductive logic programming vs decision tree induction.

UNIT-5 Unsupervised learning, clustering methods based on ecludian distance and probabilities, hierarchical clustering methods. Introduction to reinforcement and explanation-based learning.

Text/References:

1. Introduction to Machine learning, Nils J. Nilsson
2. Machine learning for dummies, IBM Limited ed, by Judith Hurwitz and Daniel Kirsch
3. Introduction to Machine Learning with Python A guide for data scientists, Andreas, C. Muller & Sarah Guido, O' Reilly

Course Code: MTH-S301		Breakup: 3 – 1 – 0 – 4
Course Name: **Discrete Mathematics**		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand and apply the principles of propositional and predicate logic, including truth tables, tautologies, satisfiability, and inference techniques.
CO2	Demonstrate the ability to work with sets, relations, functions, recursive definitions, equivalence relations, and lattice structures using Hasse diagrams.
CO3	Analyze and construct algebraic structures such as groups, monoids, semigroups, and apply the properties of Abelian and cyclic groups in problem-solving.
CO4	Utilize concepts of graph theory to solve problems involving paths, circuits, connectedness, and spanning trees using algorithms like Dijkstra's, Kruskal's, and Prim's.
CO5	Apply Boolean algebra to switching circuits and digital logic design, understanding the role of Boolean identities and sub-algebraic structures.

Course Details:
Unit I Introduction to formal logic, Formulae of propositional logic, Truth tables, Tautology, Satisfiability, Contradiction, Normal and principle normal forms, Completeness. Theory of inference. Predicate calculus: Quantifiers, Inference Theory of predicate logic, Validity, Consistency and Completeness.

Unit II Sets, Operations on sets, Ordered pairs, Recursive definitions, Relations and Functions, Equivalence relations, Composition of relations, Closures, Partially ordered sets, Hasse Diagram's, Lattices (Definition and some properties).

Unit III Algebraic Structures: Definition, Groupoid, Monoid, Semi groups, Groups, Subgroups, Abelian groups, Cyclic groups.

Unit IV Graph Theory: Incidence, Degrees, Walks, Paths, Circuits, Characterization theorems, Connectedness, Euler graphs, Hamiltonian graphs, Travelling salesman problem, Shortest distance algorithm (Dijkstra's), Trees, Binary trees, Spanning trees, Spanning tree algorithms Kruskal's and Prim's.

Unit V Boolean Algebra: Properties of Boolean Algebra, Sub Boolean Algebra, Ideals, Switching Circuits.

Text Books and References:

1. C.L. Liu: Discrete Mathematics
2. B. Kolman, R.C. Busby, and S.C. Ross: Discrete Mathematical Structures, 5/e, Prentice Hall, 2004

3. J.L. Mott, A. Kandel and T.P. Baker: Discrete Mathematical Structures for Computer Scientists & Mathematicians, Prentice-Hall India
4. J.P. Trembley, R. Manohar: Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill, Inc. New York, NY, 1975

Course Code: HSS-S201		Breakup: 3–1 – 0–4
Course Name: **Communication Practicum**		

Course Outcome: 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 resentations- 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: ECE S301		Breakup: 3 0 3 5
Course Name: Analog and Digital Communication		

Course Outcome: At the end of the course, the student will be able to

CO1	Apply the knowledge of statistical theory of communication and explain the conventional Analog and Digital communication system.
CO2	Amplitude modulation (Single tone and Multitone), DBBSC, SSBSCVSBSC,
CO3	Frequency modulation and demodulations, PAM, PWM, PPM and Digital modulation techniques such as ASK, FSK, PSK.
CO4	Study of baseband modulation techniques and nyquist criterion for zero ISI & raised cosine spectrum. matched filter.
CO5	Knowledge of error detection and correction codes.

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, short noise, Noise figure, Noise temperature, Equivalent noise bandwidth.

Unit-II Amplitude (Linear Modulation): Concepts of Amplitude modulation (Single tone and Multi tone), Generation and detection of DSB, SSB, VSB, Carrier Acquisition, Concept of FDM, AM transmitter and Receiver. Noise in DSB-SC, SSB-SC and AM system,
Angle (Exponential Modulation): Types of Angle Modulation, Concepts of Instantaneous frequency, Wide band and Narrow band FM, Generation and detection of FM, Generation and detection of PM, Noise in FM and PM FM threshold and its extension, Pre-emphasis and De-emphasis in FM, FDM,

Unit-III Sampling theory &pulse modulation: Sampling process, sampling theorem, signal reconstruction, flattop sampling of band pass signals, Analog Pulse Modulation: Types of analog pulse modulation, Method of generation and detection of PAM, PWM, PPM, Spectrum of pulse modulation, concept of time division multiplexing. PCM, Quantization errors, Signal to noise quantization ratio, Differential pulse code modulation, adaptive DPCM, Delta modulation, Idling noise and slope overload, Adaptive delta modulation.

Unit- IV 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- V Digital modulation techniques and error correction codes: 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. 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; convolution codes, code tree &Trellis diagram, Viterbi and sequential decoding.

Textbooks:

1. Communication SystemsS.Haykin, JohnWilly&Sons.4th ed.2006.
2. Communication Systems: A.B. Carlson, TMH.2007.
3. Modem Analog & Digital Communication Systems: B.P.Lathi, OxfordUniv.Press.4th ed.2009.
4. Analog Communication Systems: P.Chakrabarti, DhanpatRai.2018.

Reference Books:

1. Taub, Herbert& Schilling, DonaldL ./“ Communication Systems”/TataMcGraw-Hill-2017.
2. Carlson, A.Bruce, Crilly, PaulB. &Rutledge, Janet C./“Communication Systems an Introduction to Signals & Noise in Electrical Communication”/ TataMcGraw-Hill.-2007.
3. Kennedy,George&Davis,Bernard/“ElectronicCommunicationSystems”/TataMcGraw-Hill/5th Ed.2011.
4. Singh, R. P .&Sapre, S.D./“Communication Systems: Analog & Digital”/TataMcGraw-Hill.-2004

Course Code: ECE S302		Breakup: 3 0 3 5
Course Name: Instrumentation and Measurements		

Course Outcome: At the end of the course, the student will be able to

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, analyzers, 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. Limited. India 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, 3rdEdition Jan.1985
3. E.O. doebilin: Measurement Systems – TMH, 6thEdition, July 2017
4. H.S. Kalsi: Electronic Instrumentation-TMH, 3rd Edition. July 2017

Course Code: ECE S303		Breakup: 3 0 0 3
Course Name: Control System		

Course Outcomes: At the end of this course, students will demonstrate the ability to:

CO1	Describe the basics of control systems along with different types of feedback and its effect. Additionally, they will also be able to explain the techniques such as block diagrams, reduction, signal flow graph and modelling of various physical systems.
CO2	Interpret the time domain response analysis for various types of inputs along with the time domain Specifications.
CO3	Distinguish the concepts of absolute and relative stability for continuous data systems along with Different methods.
CO4	Interpret the concept of frequency domain response analysis and their specifications.
CO5	Explain the concept of state variables for the representation of LTI system.

Course Details:

Unit-I Introduction to Control Systems: Basic Components of a control system, Feedback and its effect, types of feedback control systems. Block diagrams, Reduction and signal flow graphs, Modeling of Physical systems: electrical networks, mechanical systems elements, free body diagram, analogous Systems.

Unit-II Time domain Analysis of Control Systems: Time response of continuous data systems, typical test signals for the time response of control systems, unit step response, and time domain specifications, time response of a first-order system, transient response of a prototype second-order system, Steady-State error, Static and dynamic error coefficients, error analysis for different types of systems.

Unit-III Stability of Linear Control Systems: Bounded-input bounded-output stability, continuous data systems, zero-input and asymptotic stability of continuous data systems, Routh-Hurwitz criterion, Root-Locus Technique: Introduction, Properties of the Root Loci, Design aspects of the Root Loci.

Unit-IV Frequency Domain Analysis: Resonant peak and Resonant frequency, Bandwidth of the prototype Second order system, effects of adding a zero to the forward path, effects of adding a pole to the forward path, polar plot, Nyquist stability criterion, stability analysis with the Bode plot, relative stability: gain margin and phase margin.

Unit-V State-Variable Analysis: Introduction, vector matrix representation of state equation, state transition matrix, state-transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Decomposition of transfer functions, Controllability and observability, Eigen Value and Eigen Vector, Diagonalization.

Text Books:

1. I. J. Nagrath & M. Gopal, “Control System Engineering”, 6th Ed. New Age International Publishers, 2018
2. B.C. Kuo & Farid Golnaraghi, “Automatic Control Systems”, 9th Edition, John Wiley India,2008

Reference Books:

1. (Schaums Outlines Series) Joseph J. Distefano III, Allen R. Stubberud, Ivan J. Williams, “Control Systems”, 3rd Edition, TMH, Special Indian Edition, 2010.
2. A. Anand Kumar, “Control Systems”, Second Edition, PHI Learning Private Limited, 2014.
3. William A. Wolovich, “Automatic Control Systems”, Oxford University Press, 2011.

Course Code: ECE S304		Breakup: 3 0 0 3
Course Name: Power Electronics		

Course Outcomes: At the end of this course, students will demonstrate the ability to:

CO1	Demonstrate to ability to understand various power electronics devices and difference between signal level and power level devices.
CO2	Demonstrate to ability to analyze and design DC-DC converters.
CO3	Demonstrate to ability to analyze and design AC-DC Rectifiers.
CO4	Demonstrate to ability to analyze and design AC-AC controllers.
CO5	Demonstrate to ability to analyze and design of Inverters.

Course Details:

UNIT-I Fundamental of Power Electronics and Power Semiconductor Devices: Concept of Power Electronics, Application of Power Electronics, Types of Power Electronics circuits and devices, Thyristor V- I characteristics, two transistor model and methods of turn-on, Operation and steady state characteristics of power MOSFET, IGBT GTO, MCT and TRIAC. Protection of devices. Series and parallel operation of thyristors, Commutation techniques of thyristor.

UNIT-II 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 half controlled and fully controlled bridge converters. Performance Parameters, three phase half wave converters, Three phase fully controlled and half controlled bridge converters. Single phase and three phase dual converters.

UNIT-IV AC Voltage Controllers: Types of AC voltage controllers, integral cycle control, single phase voltage controllers, with R and RL loads, single-phase transformer tap changers,

Cyclo converters: Principle of cyclo converter operation, single-phase to single-phase circuit, step-up and step-down cycloconverter, three-phase half wave cycloconverter, output voltage equation of a cycloconverter.

UNIT V Inverters: Types of Single phase inverters and Three phase inverters, Voltage control of inverters, Harmonics reduction techniques, Single phase and three phase current source inverters.

Text Books:

1"Power Electronics Circuit Devices and Applications" by Rashid M. H., PHI Pub.

2. "Modern Power Electronics and AC Drives" by Bimal K Bose, Pearson Pub.

3. "Power Electronics" by Bimbhra P S, Khanna Publishers.

4. "Power Electronics" by Vedam Subrahmanyam, New Age International.

Reference Books:

1. M S. Jamil Asghar, "Power Electronics" Prentice Hall of India LU, 2004

2. A. Chakrabarti,rai & Co. 'Fundamentals of Power Electronics &Drives" Dhnnpat Rai.

Course Code: ECE S305		Breakup: 3 1 0 4
Course Name: Signals & Systems		

Course Outcome: At the end of this course, students will demonstrate the ability to

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 & nonperiodic, 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. 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 differenceequation with non-zero initial condition.

Textbook

1. Oppenphim, A.S. Willsky and S.H. Nawab; signals and systems, prentice Hall. 2nd 2023
2. B.P. Lathi, Signal and Linear Systems, Oxford University press, New Delhi. January 2016

Reference Books:

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

Course Code: HSS-S302		Breakup: 3–1 – 0–4
Course Name: **Industrial Management**		

Course Outcome: 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: ECE S306		Breakup: 3 0 3 5
Course Name: Digital Signal Processing		

Course Outcomes: At the end of this course, students will demonstrate the ability to:

CO1	Design and describe different types of realizations of digital systems (IIR and FIR) and their utilities.
CO2	Select design parameters of analog IIR digital filters (Butterworth and Chebyshev filters) and implement various methods, such as impulse invariant transformation and bilinear transformation of conversion of analog to digital filters.
CO3	Design FIR filter using various types of window functions.
CO4	Define the principle of the discrete Fourier transform & its various properties and the concept of circular and linear convolution. Also, students will be able to define and implement FFT i.e. a fast computation method of DFT.
CO5	Define the concept of decimation and interpolation. Also, they will be able to implement it in various practical applications

Course Details:

UNIT-I Introduction to Digital Signal Processing: Basic elements of digital signal processing, advantages and disadvantages of digital signal processing, Technology used for DSP.
Realization of Digital Systems: Introduction- basic building blocks to represent a digital system, recursive and non-recursive systems, basic structures of a digital system: Canonic and Non-Canonic structures. **IIR Filter Realization**: Direct form, cascade realization, parallel form realization, Ladder structures- continued fraction expansion of H (z), example of continued fraction, realization of a ladder structure, design examples. **FIR Filter Realization**: Direct, Cascade, FIR Linear Phase Realization and design examples.

UNIT-II Infinite Impulse Response Digital (IIR) Filter Design: Introduction to Filters, Impulse Invariant Transformation, Bi-Linear Transformation, All- Pole Analog Filters: Butterworth and Chebyshev, Design of Digital Butterworth and Chebyshev Filters, Frequency Transformations.

UNIT-III Finite Impulse Response Filter (FIR) Design: Windowing and the Rectangular Window, Gibb's phenomenon, Other Commonly Used Windows (Hamming, Hanning, Bartlett, Blackmann, Kaiser), Examples of Filter Designs Using Windows. **Finite Word length effects in digital filters**: Coefficient quantization error, Quantization noise – truncation and rounding, Limit cycle oscillations-dead band effects

UNIT-IV DFT & FFT: Definitions, Properties of the DFT, Circular Convolution, Linear Convolution using Circular Convolution, Decimation in Time (DIT) Algorithm, Decimation in Frequency (DIF) Algorithm.

UNIT-V Multirate Digital Signal Processing (MDSP): Introduction, Decimation, Interpolation, Sampling rate conversion: Single and Multistage, applications of MDSP, Advantages of MDSP.

Text Books:

1. John G Prokias, Dimitris G Manolakis, Digital Signal Processing, Pearson, 4th Edition, 200
2. Johnny R. Johnson, Digital Signal Processing, PHI Learning Pvt Ltd., 2009.
3. S. Salivahanan, A. Vallavaraj, Digital Signal Processing, TMH, 4th Edition 2017.

Reference Books:

1. Oppenheim & Schafer, Digital Signal Processing. Pearson Education 2015
2. S.K. Mitra, 'Digital Signal Processing–A Computer Based Approach, TMH, 4th Edi
3. Digital Signal Processing-a computer-based approach by S. K. Mitra, McGraw Hill.
4. Digital Signal Processing - a modern introduction by Ashok Ambardar, Cengage lear

Course Code: ECE S307		Breakup: 3 0 3 5
Course Name: Fiber Optics Communication		

Course Outcome: At the end of the course, the student will be able to

CO1	Recognize and classify the structures of Optical fibre and types.
CO2	Transmission Characteristics of fibre like attenuation and dispersion. Analyze 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, analyze 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 splicingtechnique, fiber connectors.

Unit – III Optical sources 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

Reference Books:

1. Bhattacharya, Pallab / "Semiconductor Optoelectronics Devices" / PearsonEducation.-2017
2. Singh,Jasprit/"OptoelectronicsanIntroductiontoMateria lsandDevices"/ McGraw-Hill-1996
3. Khare,R.P./"FiberOptics&Optoelectronics"/OxfordUniversityPress-2004
4. Gupta,S.C./"TextBookofOpticalFiberCommunication&ItsApplications"/Prentice–Hall (India).-2013

Course Code: ECE S308		**Breakup: 3 1 0 4**
Course Name: VLSI Design &Technology		

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	Analysis of the operation of MOS transistor
CO6	Analysis of the physical design process of VLSI design flow
CO7	Analysis of the design rules and layout diagram
CO8	Design of combinational and sequential Circuits.
CO9	Fundamental knowledge of verilog.

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. VLSI Design Rules, IC Layout,The MOSFET Transistors: The MOS Transistor Under Static Condition, Secondary Effects, Scaling, Circuit Simulation.

Unit-IV 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-V Introduction to Verilog, Gate level modelling, Behavioral modelling, Data flow modelling, Switch level modelling, Synthesis of combinational logic and sequential logic using Verilog

Text Book:

1. Sze, S.M./ “VLSI Technology” / Tata McGraw-Hill / 2nd Ed-2017
2.Debaprasad Das/ “VLSI Design”/Oxford University Press/2nd Edition-2015
3. Design through Verilog HDL-T. R. Padmanabhan and B. Bala Tripura Sundari; WSE, IEEE Press, 2004

Reference Books:

1. Kang,Sun-moand 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/“DesignofAnalogCMOSintegratedcircuits”/TataMcGraw-Hill.-2003
4. Weste,N.H.E.&Eshraghian,K./“PrinciplesofCMOSVLSIDesign”/PearsonEducationAsia-1993
5.Streetman,B.G.&Banerjee,Sanjay/“SolidStateElectronicDevices”/PrenticeHall(India)/6thEd. 2006

Course Code: HSS-S301		Breakup: 3–1 – 0–4
Course Name: **Engineering Economics**		

Course Outcome: 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 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-I

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

UNIT-II

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-III

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-IV

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

UNIT-V

- 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, 2

Course Code: ECE S401		Breakup: 3 0 3 5
Course Name: Wireless & Mobile Communication		

Course Outcome: At the end of the course, the student will be able to

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 analyze different multiple access techniques in mobile communication.
CO4	Equalization and different diversity techniques and can apply the concept of GSM in real time applications.

Course Details:

Unit-I Ccellular mobile standards: Cellular concepts- Cell structure, frequency reuse, cell splitting, channel assignment, handoff, interference, capacity, power control; Evolution of Mobile Communication, Ooverview of 2G 3G, 4G and 5G

Unit-II Signal propagation- Propagation mechanism, reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Antennas: antennas for mobile terminal, base station antennas and array.

Unit-III Fading channels-Multipath and small-scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading.

Unit-IV Spread spectrum modulation techniques: Pseudo-noise sequence, direct sequence spread Spectrum (DS-SS), frequency hopped spread spectrum (FHSS), performance of DS-SS and FH-SS, Multiple access schemes-FDMA, TDMA, CDMA and SDMA. Modulation schemes- QAM, MSK and GMSK, multicarrier modulation, OFDM.

Unit-V Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization: linear-ZFE and adaptive, DFE. MIMO and space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text Books:

1. Erik Dahlman, 4G, LTE-Advanced Pro and The Road to 5G
2. Sassan Ahmadi, 5G NR: Architecture, Technology, Implementation, and Operation of
3. Schiller, J. / "Mobile Communication" / Pearson Education / 2ndEd.-2008
4. T.S. Rappaport, "Wireless Communication-Principles and practice", Pearson-2010

Reference Books:

1. Willium C. Y. Lee, "Mobile communication Design and fundamentals" / 2ndEd.-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 S501		Breakup: 3 0 0 3
Course Name: Data Communication and Computer Networks		

Course Outcome: At the end of the course, the student will be able to

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 Introduction to computer networks and Internet: Introduction to Data Network and ISO-OSI protocol, Fundamentals of Physical Layer and different modes of data communication. Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local Area Networks, addressing, Ethernet, Hubs, Switches.

Unit – II 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 selective repeat. datalink protocols PPP, HDLC

Unit – III Network layer: Virtual circuit and Datagram networks, Router, Internet Protocol, Routing algorithms, Broadcast and Multicast routing.

Unit – IV Transport layer: Connectionless transport - User Datagram Protocol, Connection-oriented transport – Transmission Control Protocol, Remote Procedure Call. Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP congestion Control, Congestion Avoidance Mechanisms and Quality of Service.

Unit – V Application layer: Principles of network applications, The Web and Hyper Text Transfer Protocol, File transfer, Electronic-mail, Domain name system, Peer-to-Peer file sharing, Socket programming, Layering concepts.

Textbooks:

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

Reference Books:

1. BlackU./"Computer Networks: Protocols,StandardsandInterfaces"/Prentice Hall(India)/2nd Ed.-1991
2. Shay, WilliamA./"Understanding Data communications & Networks"/Vikas Publishing House Pvt.Ltd.-1999

Course Code: ECE S502		Breakup: 3 0 0 3
Course Name: Advanced Engineering Materials		

Course Outcome: At the end of the course, the student will be able to

CO1	Selection of materials for modern engineering applications.
CO2	Structure and properties of metals, ceramics and polymers starting with fundamental atomic properties.
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. Study of Advanced Engineering Materials.

Course Details:

Unit–I Crystal Structure of Materials: Bonds in solids, crystal structure, co-ordination number, atomic packing factor, Miller Indices, Bragg's law and x-ray diffraction, structural Imperfections, crystal growth.
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: Electronic theory of metals, factors affecting electrical resistance of materials, thermal conductivity of metals, heat development in current carrying conductors, thermoelectric effect, superconductivity and superconducting 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, Formation and fabrication of P-N junction diode, Recombination, junction transistor, FET&IGFET, properties of semiconducting materials.

Unit–IV Magnetic & Dielectric Properties of Material: Origin of permanent magnetic dipoles in matters, Classification of magnetic materials: Diamagnetism, Paramagnetism, 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 Advanced Engineering Materials: Super alloys, Smart materials, Mettaic glass, production and application, Liquid crystal, production , properties and applications, Metals for high temperature, Nano technology and nano materials.

Text Books:

1. A.J. Dekker," Electrical Engineering Materials" Prentice Hall of India, January1970
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.
4. W.E Smith, Structure and Properties of Engineering Allyoys, Mc. GrawHill 1993
5. K.K Chawla, Composite Materials, 2nd Edition, Springer- Verilog.

References:

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

Course Code: ECE S503		Breakup: 3 0 0 3
Course Name: Microwave Engineering		

Course Outcome: At the end of the course, the student will be able to

CO1	To get familiarized with microwave frequency bands, their applications and to understand the limitations and losses of conventional tubes at these frequencies.
CO2	To develop the theory related to microwave transmission lines, and to determine the characteristics of rectangular waveguides, micro strip lines, and different types of waveguide components and ferrite devices.
CO3	To distinguish between different types of microwave tubes, their structures and principles of microwave power generation, and to characterize their performance features and applications - at tube levels as well as with solid state devices.
CO4	To impart the knowledge of Scattering Matrix, its formulation and utility, and establish the S-Matrix for various types of microwave junctions.
CO5	To understand the concepts of microwave measurements, identify the equipment required and precautions to be taken, and get familiarized with the methods of measurement of microwave power and various other microwave parameters

Course Details:

UNIT - I Microwave Transmission Lines - I: Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Rectangular Waveguides – Solution of Wave Equations in Rectangular Coordinates, TE/TM mode analysis, Expressions for Fields, Characteristic Equation and Cut-off Frequencies, Filter Characteristics, Dominant and Degenerate Modes, Sketches of TE and TM mode fields in the cross-section, Mode Characteristics – Phase and Group Velocities, Wavelengths and Impedance Relations, Power Transmission, Impossibility of TEM Mode. Illustrative Problems, Micro strip Lines– Introduction, Zo Relations, Effective Dielectric Constant.

UNIT - II Cavity Resonators– Introduction, Rectangular Cavities, Dominant Modes and Resonant Frequencies, Q Factor and Coupling Coefficients, Illustrative Problems Waveguide Components and Applications: Coupling Mechanisms – Probe, Loop, Aperture types. Waveguide Discontinuities – Waveguide Windows, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Resistive Card and Rotary Vane Attenuators; Waveguide Phase Shifters – Types, Dielectric and Rotary Vane Phase Shifters, Waveguide Multiport Junctions – E plane and H plane Tees, Magic Tee. Directional Couplers – 2 Hole, Bethe Hole types, Illustrative Problems Ferrites– Composition and Characteristics, Faraday Rotation, Ferrite Components – Gyrator, Isolator, Circulator.

UNIT - III Microwave Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications, O-type Tubes: 2 Cavity Klystrons – Structure, Reentrant Cavities, Velocity Modulation Process and Applegate Diagram, Bunching Process and Small Signal Theory – Expressions for O/P Power and Efficiency. Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes and O/P Characteristics, Illustrative Problems. Helix TWTs: Significance, Types and Characteristics of Slow Wave Structures; Structure of TWT and Amplification Process (qualitative treatment), Suppression of Oscillations, Gain Considerations

UNIT - IV M-Type Tubes: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartree Conditions, Modes of Resonance and PI-Mode Operation, Separation of PI-Mode, o/p characteristics, Illustrative Problems
Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diodes – Principle, RWH Theory, Characteristics, Modes of Operation - Gunn Oscillation Modes, Introduction to Avalanche Transit Time Devices.

UNIT - V Scattering Matrix– Significance, Formulation and Properties, S Matrix Calculations for – 2 port Junctions, E plane and H plane Tees, Magic Tee, Circulator and Isolator, Illustrative Problems. Microwave Measurements.

TEXT BOOKS:

1. Microwave Devices and Circuits – Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.

REFERENCES:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Engineering - G.S. Raghuvanshi, Cengage Learning India Pvt. Ltd., 2012.
3. Microwave Engineering Passive Circuits – Peter A. Rizzi, PHI, 1999.
4. Microwave Engineering - David M. Pozar, John Wiley & Sons (Asia) Pvt Ltd., 1989, 3r ed., 2011 Reprint.

Course Code: ECE S504		Breakup: 3 0 0 3
Course Name: Data Structures and Algorithms Design		

Course Objective

CO1	Introduce fundamental data structures such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and explain their operations, applications, and trade-offs.
CO2	Develop the ability to design and analyze algorithms for solving computational problems using appropriate data structures.
CO3	Understand complexity analysis through Big O notation to evaluate algorithm efficiency in terms of time and space.
CO4	Explore algorithm design techniques such as divide and conquer, greedy methods, dynamic programming, backtracking, and graph algorithms.
CO5	Enable students to apply data structures and algorithms to real-world problems and optimize performance in software development.

Course Details:

UNIT - V Stacks: Basic Stack Operations, Representation of a Stack using Static Array and Dynamic Array, Multiple stack implementation using single array, Stack Applications: Reversing list, Factorial Calculation, Infix to postfix Transformation, Evaluating Arithmetic Expressions and Towers of Hanoi.

UNIT - V Queues: Basic Queue Operations, Representation of a Queue using array, Implementation of Queue Operations using Stack, Applications of Queues-Round Robin Algorithm. Circular Queues, De Queue Priority Queues. Linked Lists: Introduction, single linked list, representation of a linked list in memory, Different Operations on a Single linked list, reversing a single linked list, Advantages and disadvantages of single linked list, circular linked list, double linked list and Header linked list.

UNIT - V Searching Techniques: Sequential and binary search. Sorting Techniques: Basic concepts, Sorting by: bubble sort, Insertion sort, selection sort, quick sort, heap sort, merge sort, radix sort and counting sorting algorithms

UNIT - V Trees: Definition of tree, Properties of tree, Binary Tree, Representation of Binary trees using arrays and linked lists, Operations on a Binary Tree, Binary Tree Traversals (recursive), Binary search tree, B-tree, B+ tree, AVL tree, Threaded Binary tree.

UNIT - V Graphs: Basic concepts, Different representations of Graphs, Graph Traversals (BFS & DFS), Minimum Spanning Tree (Prims & Kruskal), Dijkstra's shortest path algorithms. Hashing: Hash function, Address calculation techniques, and Common hashing functions, Collision resolution: Linear and Quadratic probing, Double hashing.

Text/References:

1. An Introduction to data structures with applications By Jean-Paul Tremblay, P. G. Sorenson, TMH
2. Data Structures in C/C++, Horowitz, Sawhney, Galgotia
3. Data Structures in C/C++, Tanenbaum, Pearson
4. Data Structures and Algorithms, Aho and Ullman

Course Code: ECE S505		Breakup: 3 0 0 3
Course Name: Introduction to MEMS		

Course Outcome: After completion of the course student will be able to:

CO1	Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, and Piezoresistive Sensor.
CO2	Explain Mechanics of Beam and Diaphragm Structures.
CO3	Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
CO4	Know the concept of Electrostatic Actuation.
CO5	Understand the applications of MEMS in RF

Course Details:

Unit-I Introduction to MEMS: MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors/Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.

Unit-II Mechanics of Beam and Diaphragm Structures: Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.

Unit-III Air Damping: Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.

Unit-IV Electrostatic Actuation: Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.

Unit-V Thermal Effects: Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors.
Applications of MEMS in RF MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Micro resonator Modeling, Micromechanical Resonator Limitations.

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, “Micro and smart systems”, Wiley India, 2010.
2. S.M. Sze, “Semiconductor Sensors”, John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, “Sensors and Transducers”, McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, “Micro sensors”, IEEE Press.

Course Code: ECE S506		Breakup: 3 0 0 3
Course Name: Adaptive Signal Processing		

Course Outcomes: At the end of this course, students will demonstrate the ability to:

CO1	Understand the general concepts of adaptive filtering and estimation.
CO2	Analyze different types of adaptive filters used in signal processing.
CO3	Solve numerical problems on correlation, convergence and filtering aspects.
CO4	Evaluate and compare different adaptive signal processing techniques.

Course Details:

Unit-I General concept of adaptive filtering and estimation: Applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.

Unit-I Adaptive Filters: Optimal FIR (Wiener) filter, Method of steepest descent, extension to complex valued LMS algorithm (real, complex), convergence analysis, weight error correlation matrix, excess mean square error and mis-adjustment, variants of the LMS algorithm: the sign LMS family, normalized LMS algorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering.

Unit-I Signal space concepts: Introduction to finite dimensional vector space theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, Gram-Schmidt orthogonalization, concepts of orthogonal projection, orthogonal decomposition of vector spaces, vector space of random variables, correlation as inner product, forward and backward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.

Unit-I Recursive least squares (RLS): Introduction to recursive least squares (RLS), vector space formulation of RLS estimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters.

Unit-I Advanced topics: Affine projection and subspace-based adaptive filters, partial update algorithms, QR decomposition, and systolic array.

Text/Reference Books:

1. S. Haykin, Adaptive filter theory, Prentice Hall, 2000.
2. Bernard Widrow and Samuel D. Stearns, Adaptive signal processing, Prentice Hall, 1984.
3. Tulay Adali and Simon Haykin, Adaptive Signal Processing: Next Generation Solutions; Wiley-IEEE Press, 2016

Course Code: ECE S507		Breakup: 3 0 0 3
Course Name: Antenna and Wave Propagation		

Course Outcome: After completion of the course student will be able to:

CO1	Explain the fundamental concepts of antennas, including radiation mechanisms, antenna parameters, and radiation patterns.
CO2	Analyze and design antenna arrays and evaluate their performance in various configurations.
CO3	Design, model, and assess special types of antennas such as travelling wave antennas, Yagi-Uda arrays, loop antennas, helical antennas, log-periodic antennas, and micro strip patch antennas.
CO4	Understand the architecture, operation, and benefits of smart antennas in modern wireless communication systems.
CO5	Explain different modes of electromagnetic wave propagation, including surface waves, space waves, and ionospheric propagation.

Course Details:

Unit-I Antenna Principles: Electric and Magnetic Fields due to alternating current element, Near-field and Far-field Regions, Application to short antennas, Radiation from Monopole and Half-Wave Dipole. **AntennaParameters**– Radiation Resistance, Antenna Polarization, Radiation Patterns, Beam Width, Radiation Intensity. Beam Area, Directivity, Gain, Antenna Aperture, Effective length, Equivalence of characteristics in Transmission and Reception, Relation between Directivity and Maximum Effective Aperture, Friis Transmission Formula, Bandwidth, Antenna Temperature.

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 VHF& UHF Range Antennas: Travelling Wave Antenna, Yagi-Uda Arrays, Vee and Rhombic Antennas, Small Loop Antenna, Helical Antenna, Log-Periodic Antenna, Micro strip Patch Antenna.

Unit-IV Introduction to Smart Antennas: Need for smart antennas, standards for smart antennas, types of smart antennas, features and benefits, architecture, advantages and disadvantages of smart antennas, introduction to orthogonal signals, signal propagation: multipath and co-channel Interference. Concept and benefits of smart antennas, fixed weight beam forming basics. Adaptive beam forming. Switched beam systems, spatial division multiple access.

Unit-V 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.

Text books:

1. C. A. Balanis - Antenna Theory and Design, 4th Ed., John Wiley & Sons., 2016.
2. F.B. Gross - Smart Antennas for Wireless Communications, McGraw-Hill., 2005.

3. K.D. Prasad, Antenna and Wave propagation', Satya Prakashan, 2024

References:

1. J.D. Krauss, Antennas, TMH. - 3rd Ed., 2017
2. Antenna and Wave Propagation – Harish AR and Sachidananda M, Oxford Univ Press, 2020
3. Edward Conrad Jordan and Keith George Balmain, "Electromagnetic Waves and Radiating Systems", PHI,2nd Ed.,2020

Course Code: ECE S508		Breakup: 3 0 0 3
Course Name: Satellite Communication		

Course Outcome: At the end of the course, the student will be able to

CO1	To understand the basics of satellite orbits geostationary and non-geostationary orbits.
CO2	To acquire the knowledge about launching procedures and understand the satellite segments.
CO3	To understand the G/T Ratio-Performance Impairments-System noise. The Equipment Measurements on G/T, C/N, EIRP was discussed.
CO4	To understand the basics of Modulation and Multiplexing and Spread Spectrum Communication.
CO5	Demonstrate the basic principle of RADARS system and Solve the RADARE equation and to calculate Transmitter power.
CO6	Analyses 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 of International & Indian satellite system, 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. Doppler effect.

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.PURE ALOHA, Satellite packet switching, Slotted ALOHA, Packet reservation, Tree algorithm.

Unit-IV Radar Systems: Basic Principles, Radar equation, Radar Performance Factors, Basic Pulsed Radar System, Radar Antenna and Scanning, Moving Target Indication, Radar navigation and global positioning system.

Textbooks:

1. Satellite Communications/Pratt, Bostian, Allnutt/JohnWiley&Sons. -2003
2. Satellite Communications/Dennis Roddy/McGraw-Hill-July2017

Reference Books:

1. Digital Satellite Communications/TriT.Ha. /McGraw-Hill. -2017
2. Electronics Communications System/Kennedy. /McGraw-Hill-5thEd.2

Course Code: ECE S509		Breakup: 3 0 0 3
Course Name: Renewable Energy Systems		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand the fundamental concepts, availability, and classification of various non-conventional energy resources, along with their advantages and limitations.
CO2	Analyze the working principles, materials, and performance parameters of solar thermal energy systems including flat plate
CO3	Explain the mechanisms of geothermal, MHD, and fuel cell-based energy conversion systems,
CO4	Evaluate the working principles and limitations of thermo-electric, thermionic, and wind energy systems, including rotor design and site selection criteria.

Course Details:

Unit-I Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

Unit-II Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations

Unit-III Geothermal Energy: Resources of geothermal energy, thermodynamics of geo- thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations.

Unit-IV Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

Unit-V Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Text Book:

1. Raja etal, “Introduction to Non-Conventional Energy Resources” SciTech Publications.
2. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications, 2006.
3. D.S. Chauhan,” Non-conventional Energy Resources” New Age International.
4. C.S. Solanki, “Renewal Energy Technologies: A Practical Guide for Beginners” PHI
5. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited Press.
6. Godfrey Boyle, “Renewable Energy Power for A Sustainable Future”, Oxford University

Course Code: ECE S510		Breakup: 3 0 0 3
Course Name: Microprocessor Based Instrumentation Systems		

Course Outcome: After going through this course, the student will be able

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-I Introduction: review of Architecture & Assembly language programming of 8086, MemoryInterfacing, data transfer techniques and their implementation.

Unit-II Common peripherals and their interfacing: single chip microcontrollers – 8051 family and8086 architectures, instruction set and programming.

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

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

Unit-V 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 datasheets
2. DV Hall/microprocessor and interfacing/TMH.3rd ed. 2017
3. B.P.Singh/advanced microprocessor and microcontrollers/newage. 3rd ed. 2008

Reference Books:

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

Course Code: ECE S511		Breakup: 3 0 0 3
Course Name: Mixed Signal Design		

Course Outcome: After going through this course, the student will be able

CO1	Design a mixed signal circuit
CO2	Differentiate analog and mixed signal
CO3	Inter-conversions between signals
CO4	Design a systems involving mixed signals
CO5	Design ADCs, DACs

Course Details:

UNIT-I Introduction Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous-time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform

UNIT-II switched-capacitor filters Switched-capacitor filters- non-idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.

UNIT-III Analog to Digital Converters Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.

UNIT-IV Mixed Signal Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission

UNIT-V Phase Locked Loops Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs

Text Books:

1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint
2. Rudy V. DePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition,

Reference Books:

1. Behzad Razavi, Design of analog CMOS integrated circuits, McGraw-Hill, 2003
2. R. Jacob Baker, CMOS circuit design, layout and simulation, revised second edition, IEEE press, and 2008.
3. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.
4. R. Schauman, Design of analog filters by, Prentice-Hall 1990 (or newer editions).
5. M. Burns et al., An introduction to mixed-signal IC test and measurement by, Oxford University press, first Indian edition, 2008.

Course Code: ECE S512		Breakup: 3 0 0 3
Course Name: High Speed Electronics		

Course Outcome: At the end of the course, the student will be able to

CO No.	Course Outcome Description
CO1	Understand the fundamentals of high-speed signal behavior and transmission line theory.
CO2	Analyze and mitigate signal integrity issues such as reflections, crosstalk, and jitter.
CO3	Design high-speed interconnects and PCB layouts for performance optimization.
CO4	Evaluate high-speed devices and develop strategies for clock and power management.
CO5	Use measurement and simulation tools to validate high-speed designs and understand their real-world applications.

Course Details:

UNIT-I: Introduction to High-Speed Design & Transmission Lines Importance and applications of high-speed circuits, Analog vs. digital high-speed signals, Signal integrity fundamentals, Lumped vs. distributed systems Transmission line theory: coaxial, micro strip, stripline, Characteristic impedance, reflection coefficient, VSWR

UNIT-II: Signal Integrity and Timing Analysis Signal reflection and ringing, Termination techniques: series, parallel, Thevenin Crosstalk, ground bounce, Rise/fall time, signal skew, and jitter Timing analysis in high-speed digital systems.

UNIT-III: High-Speed Interconnects and PCB Design Controlled impedance routing, Differential pairs and their design guidelines, Effects of vias, connectors, and trace geometries, PCB layout techniques for high-speed signals

UNIT-IV: High-Speed Devices and Power/Clock Management High-speed logic families: TTL, CMOS, ECL Device parasitics: capacitance, inductance Clock distribution: PLLs, DLLs Power integrity: decoupling, bypass capacitors, and ground planes

UNIT-V: Measurements, Simulation, and Applications Signal integrity measurements: Eye diagrams, TDR, Frequency-domain tools: VNA, Simulation tools: SPICE, ADS, HFSS, Hyper Lynx Applications:- High-speed serial interfaces (USB, HDMI, PCIe), RF circuits, high-speed ADCs/DACs, Case studies in system-level high-speed design.

Textbooks and References

1. Howard Johnson & Martin Graham – High-Speed Digital Design: A Handbook of Black Magic
2. Stephen H. Hall – High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices
3. Bogdan Adamczyk – Foundations of High-Speed Electronics
4. David M. Pozar – Microwave Engineering (for RF-related aspects)

Course Code: ECE S513		Breakup: 3 0 0 3
Course Name: Introduction to Internet of Things		

Course Outcome: At the end of the course, the student will be able to

CO No.	Course Outcome Description
CO1	Understand the fundamental concepts, architecture, and applications of IoT.
CO2	Analyze the protocols and communication models used in IoT systems.
CO3	Demonstrate the ability to interface sensors and use embedded platforms like Arduino/Raspberry Pi.
CO4	Evaluate cloud integration, data management, and security aspects of IoT.
CO5	Design and implement IoT solutions for real-world applications using case studies and mini projects.

Course Details:

UNIT-I: Introduction to IoT Definition, Characteristics and Applications of IoT, Physical and logical design of IoT, Enabling technologies: Wireless sensor networks, cloud computing, big data analytics, IoT levels and deployment templates, M2M and differences between IoT and M2M.

UNIT-II: IoT Architecture and Protocols IoT reference architecture, IoT communication models and APIs IoT protocols: MQTT, CoAP, XMPP, AMQP, HTTP, DDS, Data link and network layer protocols for IoT

UNIT-III: Sensors, Actuators and Embedded Platforms Types of sensors and actuators used in IoT, Sensor networks and interfacing techniques, Overview of Arduino and Raspberry Pi platforms Interfacing sensors with embedded boards

UNIT-IV: Cloud and IoT Data Management Cloud computing for IoT Data acquisition and storage in cloud Data analytics and visualization tools Security and privacy issues in IoT

UNIT-V: Applications and Case Studies Smart cities and smart homes, Healthcare and industrial IoT, Agriculture and environment monitoring, IoT-based project development lifecycle Mini project or case study implementation

Text Books and References

1. Arshdeep Bahga and Vijay Madisetti, 'Internet of Things: A Hands-on Approach', Uni Press.
2. Raj Kamal, 'Internet of Things: Architecture and Design Principles', McGraw-Hill Edu, 2017.
3. Adrian McEwen and Hakim Cassimally, 'Designing the Internet of Things', Wiley, 2013.
4. Pethuru Raj and Anupama C. Raman, 'The Internet of Things: Enabling Technologies, Platforms, and Use Cases', CRC Press, 2017.
5. Srinivasa K. G., 'Internet of Things', Cengage Learning, 2020.

Course Code: ECE S514		Breakup: 3 0 0 3
Course Name: Advanced Microprocessor		

Course Outcome: At the end of the course, the student will be able to

CO No.	Course Outcome Description
CO1	Technical understanding of the functionality of 80286 architecture to design advanced microprocessors systems
CO2	Ability to design and use new interface techniques principle to access the peripherals
CO3	Familiarize with the internal structure of motherboard and its components
CO4	Technical knowhow in designing a new chip

Course Details:

Unit – I 80286 Architecture- Instruction set - Addressing modes - Real mode - Protected mode - 80386 Architecture - Address segmentation - Paging - Segment registers.

Unit – II Basic 486 Architecture- 486 memory system and memory management - Features of Pentium memory and I/O systems - Pentium memory management - Introduction to Pentium Pro features.

Unit – II Introduction to PCs- Study of PC system layout - SCSI, CD-ROM & multimedia - Development of PC - PC components - Features and system design - Motherboards - Buses - BIOS.

Unit – IV IDE Interface- Magnetic storage principles - Hard disk storage - Floppy disk storage - Optical Storage - Physical drive installation and configuration - Video hardware - Audio hardware.

Unit – V Input devices - Power supply chassis - Building/upgrading systems - PC diagnostics - Testing and maintenance.

Text Books

1. D. V. Hall, "Microprocessor and Interfacing Programming and Hardware", McGraw Hill, II Edition, 1999.

Reference

2. B. B. Brey, "The Intel Microprocessors 8086/8088, 80186/ 80188, 80286, 80386, 80486 and Pentium and Pentium Pro Processor", Prentice Hall of India, V Edition, 2006.

Course Code: ECE S515		Breakup: 3 0 0 3
Course Name: Advanced Semiconductor Devices		

Course Outcome: At the end of the course, the student will be able to

CO1	Analyze the effects of defects, impurities, and heterostructure design in compound semiconductors for advanced device performance optimization.
CO2	Evaluate the structure and frequency response of advanced bipolar devices including Schottky diodes, tunnel diodes, and Heterojunction Bipolar Transistors (HBTs).
CO3	Analyze advanced field-effect transistor architectures, including HEMTs, MODFETs, and FinFETs, with emphasis on short-channel behavior and quantum effects.
CO4	Apply simulation tools to model device behavior under various conditions.
CO5	Assess emerging semiconductor technologies including spintronics, 2D materials, and advanced packaging for next-generation nanoelectronic applications.

Course Details:

Unit-I: Compound Semiconductors and Device Physics Enhancements, Review of semiconductor physics: energy bands, carrier statistics. Impact of defects and impurities on device performance. Overview of III-V and II-VI compound semiconductors. Bandgap engineering and heterojunctions, Strain effects and lattice mismatch.

Unit-II: Advanced Bipolar Devices Schottky and tunnel diodes: operation and applications. Bipolar Junction Transistors (BJTs): Ebers-Moll model, high-frequency response. Heterojunction Bipolar Transistors (HBTs): design, operation and performance. SiGe and III-V HBTs: material properties and performance

Unit-III: Advanced Field-Effect Transistors MOSFETs: short-channel effects, subthreshold conduction. High Electron Mobility Transistors (HEMTs): principles and applications. Modulation-Doped Field-Effect Transistors (MODFETs). Resonant Tunneling Diodes (RTDs): operation and characteristics. Advanced FETs: FinFETs

Unit-IV: Optoelectronic and High-Frequency Devices Photodiodes, Light Emitting Diodes (LEDs) and Laser Diodes: principles and structures. Photodetectors: Avalanche photodiodes PIN, and phototransistors. Microwave devices: IMPATT, Gunn diodes. High-frequency transistors: design and applications.

Unit-V: Emerging Devices and Technologies Spintronics: spin-based devices fundamentals and device applications. Carbon-based nanomaterials: CNTs, graphene. 2D materials and van der Waals heterostructures. Advanced packaging techniques: 3D ICs, system-in-package.

References:

1. S. M. Sze and Kwok K. Ng, *Physics of Semiconductor Devices*, 3rd Edition.
2. P. Bhattacharya, *Semiconductor Optoelectronic Devices*, 2nd Edition.
3. Y. Taur and T. H. Ning, *Fundamentals of Modern VLSI Devices*, 2nd Edition.
4. G. Massobrio and P. Antognetti, *Semiconductor Device Modeling with SPICE*, 2nd Edition.
5. R. S. Muller and T. I. Kamins, *Device Electronics for Integrated Circuits*, 3rd Edition.

6. S. M. Sze and Kwok K. Ng, *Physics of Semiconductor Devices*, 3rd Edition.
7. P. Bhattacharya, *Semiconductor Optoelectronic Devices*, 2nd Edition.
8. B. Jayant Baliga, *Fundamentals of Power Semiconductor Devices*.
9. S. M. Sze and Kwok K. Ng, *Physics of Semiconductor Devices*, 3rd Edition.

Textbooks

1. Pierret, R. F., *Advanced Semiconductor Fundamentals*, 2nd Edition.
2. Taur, Y., & Ning, T. H., *Fundamentals of Modern VLSI Devices*, 3rd Edition.
3. Neamen, D. A., *Semiconductor Physics and Devices*.
4. Muller, R. S., & Kamins, T. I., *Device Electronics for Integrated Circuits*, 3rd Edition.
5. Sze, S. M., *Physics of Semiconductor Devices*.
6. S. M. Sze and Kwok K. Ng, *Physics of Semiconductor Devices*, 3rd Edition.
7. Y. Taur and T. H. Ning, *Fundamentals of Modern VLSI Devices*, 2nd Edition.
8. P. Bhattacharya, *Semiconductor Optoelectronic Devices*, 2nd Edition.

Course Code: ECE S516		Breakup: 3 0 0 3
Course Name: Advanced Mobile Communication		

Course Outcome: At the end of the course, the student will be able to

CO1	Aim of the course is to provide students advanced level of theoretical knowledge on mobile computing
CO2	The knowledge from the mobile computing architecture to database for mobile computing and data synchronization analysis will make students enrich enough to work in mobile computing area either in research field or in industry.
CO3	Describe Mobile Computing application architecture
CO4	Explain Mobile computing databases.
CO5	Describe synchronization techniques for mobile data.

Course Details:

Unit-I Introduction to mobile computing, Novel applications of mobile computing, Limitations of mobile computing.

Unit-II Mobile computing architecture and environment: Programming languages, Operating system functions, Functions of middleware for mobile systems, Mobile computing architectural layers.

Unit-III Mobile computing application architecture: Reconfigurable Access module for mobile computing applications (RAMON). Functional architecture of RAMON, Algorithm description, control parameters and user plane interaction, mobility management algorithm, handover decision and execution, session control and error control algorithm, Radio resource control algorithm, radio resource sharing, simulative approach, performance issues.

Unit-IV Databases for mobile computing: Data organization, Database transaction models, Query processing, Data recovery process, Data caching.

Unit-V Data synchronization: Synchronization in mobile computing systems, conflict resolution strategies, overview of synchronization software for mobile devices. Synchronization protocols, SyncML programming model for mobile computing, SyncML protocol, SMIL.

Text and Reference Book:

1. Architectures and protocols for mobile computing applications: a reconfigurable approach Carla-Fabiana Chiasserini a, Francesca Cuomo b, *, Leonardo Piacentini c,

Course Code: ECE S517		Breakup: 3 0 0 3
Course Name: Biomedical Instruments		

Course Outcome: At the end of the course, the student will be able to

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 Measurement: Electrocardiography-ECG amplifier, Electrodes and leads, ECG recorders- three channel, Vector cardiographs, ECG for stress testing, Continuous ECG recording (Holter recording), Blood pressure measurement, Blood flow measurement, Heart sound measurements.

Patient Caring and monitoring: Elements of intensive care monitoring, patient monitoring display, Diagnosis, calibration and Repairability patient monitoring equipments, pacemaker and defribrillators.

Unit-IV Measurements in Respiratory system: Physiology of respiratory system Measurement of breathing mechanics -Spirometer.

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 2000

Reference Books:

1. Khandpur R.S./ "Biomedical Instrumentation"/ TataMcGraw-Hill.2003
2. Tompkins/"Biomedical DSP: C Language Examples and Lab Experiments for the IBM PC"/Prentice Hall(India).2015.

Course Code: ECE S518		Breakup: 3 0 0 3
Course Name: Nano-electronics		

Course Outcomes: At the end of the course, students will demonstrate the ability to

CO1	Understand various aspects of nano technology and the processes involved in making nano components and material.
CO2	Leverage advantages of the nano-materials and appropriate use in solving practical problems
CO3	Understand various aspects of nano-technology and the processes involved in making nano components and material
CO4	Leverage advantages of the nano-materials and appropriate use in solving practical problems

Unit-I Overview: Nanodevices, Nanomaterials, Nano characterization. Introduction to nano-electronics, CMOS technology scaling issues, Design techniques for Nano scale transistors

Unit-II Materials for nano electronics: Semiconductors, Crystal lattices: bonding in crystals, Electron energy bands, Semiconductor hetero structures, Lattice-matched and pseudo morphic heterostructures, Inorganic nanowires, Organic semiconductors, Carbon nanomaterials: Nanotube sand fullerenes.

Unit-III Shrink-down approaches: Introduction, CMOS Scaling, MOS Electrical characterization, Nonclassical MOSFETs: overview and carrier transport in Nano MOSFETs, Silicon on Insulator (SOI) MOSFET, FINFETs, Vertical MOSFETs, limits to scaling, system Integration limits (interconnect issues etc.)

Unit-IV Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/Reference Books:

1. G.W.Hanson, Fundamentals of Nano electronics, Pearson, 2023.
2. W.Ranier, Nano electronics and Information Technology (Advanced Electronic Material and Nove lDevices), Wiley-VCH, 2022.
3. K.E. Drexler, Nano systems, Wiley, 2024.
4. J.H.Davies, the Physics of Low-Dimensional Semiconductors, Camb Uni Press, 2024.
5. C.P.Poole, F.J.Owens, Introduction to Nano technology, Wiley, 2023.
6. Introduction to Nano Science and Technology by S.M.Lindsay.

Course Code: ECE-S519		Breakup: 3 –0 – 0 – 3
Course Name: Wireless Sensor Network		

Course Outcome: At the end of the course, the student will be able to

CO1	Technical knowhow in building a WSN network.
CO2	Analysis of various critical parameters in deploying a WSN.
CO3	To understand the issues pertaining to sensor networks and the challenges involved in managing a sensor network

Course Details:

Unit – I Introduction: Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

Unit –II Introduction to adhoc/sensor networks: Key definitions of adhoc/ sensor networks, unique constraints and challenges, advantages of ad-hoc/sensor network, driving applications, issues in adhoc wireless networks, issues in design of sensor network, sensor network architecture, data dissemination and gathering.

Unit – III MAC Protocols: Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

Unit – IV Routing Protocols: Issues in designing a routing protocol, classification of routing protocols, table-driven, on-demand, hybrid, flooding, hierarchical, and power aware routing protocols.

Unit – V QoS and Energy Management: Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

Text Book

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.

Reference Book

1. Feng Zhao and Leonides Guibas, "Wireless sensor networks ", Elsevier publication - 2004.
2. Jochen Schiller, "Mobile Communications", Pearson Education, 2nd Edition, 2003.
3. William Stallings, "Wireless Communications and Networks ", Pearson Education – 2004

Course Code: ECE-S520		Breakup: 3 –0 – 0 – 3
Course Name: Information Coding		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand the basics of Information theory, techniques of coding and decoding.
CO2	Analyze and compare different coding and decoding schemes Evaluate
CO3	Solve numerical problems on channel capacity and coding.
CO4	Evaluate and case study broadcast channels for different coding schemes and also multiuser channel coding.

Course Details:

Unit – I Basics of information theory: Entropy for discrete ensembles; Shannon's noiseless coding theorem; Encoding of discrete sources. Markov sources, Shannon's noisy coding theorem and converse for discrete channels, Calculation of channel capacity and bounds for discrete channels, application to continuous channels.

Unit –II Techniques of coding and decoding: Channel Coding, Block and convolutional codes; majority logic decoding; Viterbi decoding algorithm, Coding gains and performance. Huffman codes and uniquely detectable codes; Cyclic codes, convolutional arithmetic codes

Unit – III Network Information Theory: Overview of multiple access channel (MAC), Achievable result for MAC using successive decoding technique, Outer bound on the capacity region of MAC and its capacity analysis, Gaussian MAC and its capacity analysis.

Unit – IV Introduction to broadcast channel: Superposition coding scheme and its optimality for the degraded broadcast channel, Relation between the capacity region of Gaussian BC and MAC. Achievable rate for interference limited networks using conventional techniques such as timesharing and treating interference as noise.

Unit – V Introduction to channel coding for multi users: Introduction, Block codes for the binary adder channel, Trellis codes for the multiple access channel.

Text/Reference Books:

1. N. Abramson, Information and Coding, McGraw Hill, 1963.
2. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.
3. R.B. Ash, Information Theory, Prentice Hall, 1970.
4. Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.
5. A. El Gamal and Y. H. Kim, Network Information Theory, Cambridge University Press, 2011

Course Code: ECE-S521		Breakup: 3 –0 – 0 – 3
Course Name: Artificial Neural Networks		

Course Outcome: At the end of the course, the student will be able to

CO1	To gain exposure in the field of neural networks and relate the human neural system into the digital world
CO2	To provide knowledge of computation and dynamical systems using neural networks

Course Details:

Unit – I Perceptron Architecture- Single-Neuron Perceptron- Multi-Neuron Perceptron-

Unit – II Perceptron Learning Rule- Constructing Learning Rules- Training Multiple-Neuron Perceptrons.

Unit – III Simple Associative Networks- Unsupervised Hebb Rule- Hebb Rule with Decay-Instar Rule-Outstar Rule- Kohonen Rule.

Unit – IV Adaline Network- Madaline Network -Mean Square Error- LMS Algorithm- Back Propagationa Neural networks – Hopfield Networks

Unit – V Adaptive Filtering- Adaptive Noise Cancellation- Forecasting – Neural control applications – Character recognition.

Text/Reference Books:

1. Hagan Demuth Beale, 'Neural network design', PWS publishing company, 1995
2. Freeman, J.A and Skapura, D.M., 'Neural networks-Algorithms, applications and programming techniques' Addison Wesley, 1991
3. Satish Kumar, Neural Networks – A classroom approach', Tata McGraw-Hill Publishing Company Limited, 2004

Course Code: ECE S522		Breakup: 3 0 2 5
Course Name: Embedded Systems		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand the architecture and programming model of embedded processors and microcontrollers
CO2	Interface and program peripheral devices such as ADC, DAC, timers, and serial communication modules
CO3	Analyze embedded system design using RTOS concepts.
CO4	Design real-time embedded applications using interrupt handling and scheduling techniques.
CO5	Develop embedded C programs for microcontroller-based systems.

Course Details:

Unit-I Introduction to Embedded Systems: Overview of embedded systems, classification, applications, and design challenges. Embedded hardware units – processor, memory, I/O devices. Embedded system design process and characteristics.

Unit-II Microcontrollers and Architecture: Architecture of 8051 and ARM-based microcontrollers, Instruction set of 8051, programming using Embedded C. Stack, subroutines, and interrupt handling in microcontrollers.

Unit-III Interfacing and I/O Devices: I/O programming, timers and counters, serial communication (UART, SPI, I2C), ADC/DAC interfacing, sensor and actuator interfacing. Use of development boards like Arduino or STM32.

Unit-IV Embedded System Software and RTOS: Introduction to embedded software and development tools. Basics of Real-Time Operating Systems (RTOS): task, process, threads, scheduling, context switching, synchronization using semaphores, mutexes, and message queues.

Unit-V Embedded System Applications and Case Studies: Real-time embedded system examples in IoT, automotive, medical, and industrial applications. Software/hardware co-design. Embedded system design using simulation tools like Keil, Proteus, or MPLAB

Text Books:

1. Raj Kamal, *Embedded Systems: Architecture, Programming and Design*, Tata McGraw- Hill, 3rd Edition.
2. Shibu K.V., *Introduction to Embedded Systems*, Tata McGraw-Hill, 2nd Edition.

Reference Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Education.
2. Wayne Wolf, *Computers as Components: Principles of Embedded Computing System Design*, Morgan Kaufmann.
3. Jonathan W. Valvano, *Embedded Systems: Real-Time Operating Systems for ARM Cortex-M Microcontrollers*, CreateSpace.

Course Code: ECE-S523		Breakup: 3 –0 – 0 – 3
Course Name: Cyber Security		

Course Outcome: At the end of the course, the student will be able to

CO1	Understand fundamental concepts of cyber security, cyber threats, and risk management.
CO2	Analyze vulnerabilities, exploits, and attack vectors in networked systems.
CO3	Apply cryptographic techniques to secure communication and data integrity
CO4	Implement security measures such as firewalls, IDS/IPS, and access controls.
CO5	Develop strategies for ethical hacking, digital forensics, and secure coding practices.

Course Details:

Unit – I Introduction to Cyber Security: Fundamentals of cyber security, threat landscape, goals of security (confidentiality, integrity, availability), types of attacks, cyber ethics, legal and regulatory aspects

Unit –II Cryptography and Network Security: Symmetric and asymmetric encryption, public key infrastructure, hashing, digital signatures, SSL/TLS, secure email, VPNs.

Unit – III System and Network Security: Network protocols and vulnerabilities, firewalls, intrusion detection/prevention systems (IDS/IPS), wireless security, malware analysis, securing operating systems

Unit – IV Application and Web Security: OWASP Top 10 vulnerabilities, SQL injection, cross-site scripting, secure software development lifecycle (SSDLC), secure coding standards.

Unit – V Ethical Hacking and Cyber Forensics: Phases of ethical hacking, penetration testing tools (e.g., Nmap, Metasploit, Wireshark), digital forensics process, tools for disk and memory forensics, incident response

Text Book

1.William Stallings, Cryptography and Network Security, Pearson Education.
2.Nina Godbole & Sunit Belpure, Cyber Security, Wiley.

Reference Book

3. Michael T. Goodrich, Introduction to Computer Security, Pearson Education.
4. Chuck Easttom, Computer Security Fundamentals, Pearson.
5. EC-Council, Ethical Hacking and Countermeasures, Cengage Learning.

Course Code: ECE-S524		Breakup: 3 –0 – 0 – 3
Course Name: Multimedia Communications		

Course Outcome: At the end of the course, the student will be able to

CO1	Deploy the right multimedia communication models
CO2	Apply QoS to multimedia network applications with efficient routing techniques.
CO3	Solve the Security issues in multimedia networks.
CO4	Solve the security threats in the multimedia networks.
CO5	Develop the real-time multimedia network applications

Course Details:

Unit – I Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles. Text, images, audio and video**.**

Unit –II Text and image compression, compression principles, text compression- Runlength, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG

Unit – III Audio and video compression, audio compression – principles, DPCM, ADPCM, Adaptive and Linear predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby coders video compression, video compression principles**.**

Unit – IV Video compression standards: H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.

Unit – V Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource management, process management techniques.

Text Book /Reference Book

1. Fred Halsall, “Multimedia Communications”, Pearson education, 2001.
2. Raif Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson education, 2002.

Course Code: ECE-S525		Breakup: 3 –0 – 0 – 3
Course Name: Digital Image Processing		

Course Outcome: At the end of the course, the student will be able to

CO1	Explain fundamentals of image processing
CO2	Compare transformation algorithms
CO3	Contrast enhancement, segmentation and compression techniques

Course Details:

Unit – I Introduction Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Examples of fields that uses digital image processing**.**

Unit –II Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit – III Image Enhancement in Frequency Domain: Introduction, Fourier Transform, Discrete Fourier Transform (DFT), properties of DFT, Discrete Cosine Transform (DCT), Image filtering in frequency domain.

Unit – IV Image Segmentation: Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold.

Unit – V Image Compression: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding, Transform Coding, Sub-image size selection, blocking, DCT implementation using FFT, Run length coding.

Text Book /Reference Book

1. Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 2 nd edition, 2008.
2. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
3. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.
4. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.
5. Digital Image Processing (with Matlab and Labview), Vipul singh, elsiver.Filip learning

Course Code: ECE-S526		Breakup: 3 –0 – 0 – 3
Course Name: IoT with Arduino, ESP, and Raspberry Pi		

Course Outcome: At the end of the course, the student will be able to

CO1	To give students hands-on experience using different IoT architectures.
CO2	To provide skills for interfacing sensors and actuators with different IoT architectures.
CO3	To develop skills on data collection and logging in the cloud.

Course Details:

Unit – I IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).

Unit –II Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts. Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.

Unit – III ESP 8266-12E Node MCU – getting started with the ESP board, Micro python and Esplorer IDE, Flushing the ESP8266 board with micro python, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST APIGET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board. Case Study: Switching light on /off remotely. Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).

Unit – IV Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless - Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.

Unit – V Raspberry pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python. New - Raspeberry Pi 4 Vs Raspberry Pi3 Mobel B Comparison, LoRawan /LPWAN – Overview

Text Books/References:

1. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
2. Baichtal, J. (2013). Arduino for beginners: essential skills every maker needs. Pearson Education.
3. Schwartz, M. (2016). Internet of Things with ESP8266. Packt Publishing Ltd.
4. Richardson, M., & Wallace, S. (2012). Getting started with raspberry PI." O'Reilly Publisher Media, Inc."