Babu Banarasi Das University, Lucknow

School of Engineering
(School Code: 04)
Department of CE/CSE/EE/ECE/ME/IT
(University Branch Code: 31/32/33/34/35/36)
Bachelor of Technology
Evaluation Scheme

Semester I									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	BAS3101	Matrices and Calculus	3	1	0	40	60	100	4
C	BAS3102	Physics-I	2	1	0	40	60	100	3
Students need to select either GROUP 'A' or GROUP 'B'									
	GP3101	General Proficiency	0	0	0	100	0	100	1
Total			5	2	0	180	120	300	8

GROUP 'A'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
F	BME3101	Engineering Mechanics	3	1	0	40	60	100	4
F	BCS3101	Foundation of Information Technology	3	1	0	40	60	100	4
F	BEC3101	Basic Electronics Engineering	3	1	0	40	60	100	4
C	BAS3104	Environmental Studies	2	0	0	40	60	100	2
F	BME3151	Engineering Mechanics Lab	0	0	2	40	60	100	1
F	BCS3151	Foundation of Information Technology Lab	0	0	2	40	60	100	1
F	BME3152	Workshop Practice	0	1	2	40	60	100	2
C	BAS3152	Physics-I Lab	0	0	2	40	60	100	1
Total			11	4	8	320	480	800	19

GROUP 'B'									
Course Category	**Course Code**	**Code Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
F	**BEE3101**	Basic Electrical Engineering	**3**	**1**	**0**	**40**	**60**	**100**	**4**
F	**BME3102**	Basic Mechanical Engineering	**3**	**1**	**0**	**40**	**60**	**100**	**4**
C	**BAS3103**	Chemistry	**3**	**1**	**0**	**40**	**60**	**100**	**4**
C	**BHS3101**	Technical Communication	**3**	**1**	**0**	**40**	**60**	**100**	**4**
F	**BEE3151**	Basic Electrical Engineering Lab	**0**	**0**	**2**	**40**	**60**	**100**	**1**
F	**BME3153**	Engineering Graphics Lab	**0**	**1**	**2**	**40**	**60**	**100**	**2**
C	**BAS3153**	Chemistry Lab	**0**	**0**	**2**	**40**	**60**	**100**	**1**
Total			**12**	**5**	**6**	**280**	**420**	**700**	**20**

Semester II									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
C	BAS3201	Differential Equations and Fourier Analysis	3	1	0	40	60	100	4
C	BAS3202	Physics-II	2	1	0	40	60	100	3
Students need to select either GROUP 'A' or GROUP 'B'									
	GP3201	General Proficiency	0	0	0	100	0	100	1
Total			5	2	0	180	120	300	8

Note: Students who have selected GROUP 'A' in the first semester will select GROUP 'B' in the second semester and Vice-Versa.

GROUP 'A'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
F	BME3201	Engineering Mechanics	3	1	0	40	60	100	4
F	BCS3201	Foundation of Information Technology	3	1	0	40	60	100	4
F	BEC3201	Basic Electronics Engineering	3	1	0	40	60	100	4
C	BAS3204	Environmental Studies	2	0	0	40	60	100	2
F	BME3251	Engineering Mechanics Lab	0	0	2	40	60	100	1
F	BCS3251	Foundation of Information Technology Lab	0	0	2	40	60	100	1
F	BME3252	Workshop Practice	0	1	2	40	60	100	2
C	BAS3252	Physics-I Lab	0	0	2	40	60	100	1
Total			11	4	8	320	480	800	19

GROUP 'B'									
Course Category	Course Code	Code Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
F	BEE3201	Basic Electrical Engineering	3	1	0	40	60	100	4
F	BME3202	Basic Mechanical Engineering	3	1	0	40	60	100	4
C	BAS3203	Chemistry	3	1	0	40	60	100	4
C	BHS3201	Technical Communication	3	1	0	40	60	100	4
F	BEE3251	Basic Electrical Engineering Lab	0	0	2	40	60	100	1
F	BME3253	Engineering Graphics Lab	0	1	2	40	60	100	2
C	BAS3253	Chemistry Lab	0	0	2	40	60	100	1
Total			12	5	6	280	420	700	20

Legends:

L	Number of Lecture Hours per week
T	Number of Tutorial Hours per week
P	Number of Practical Hours per week
CIA	Continuous Internal Assessment
ESE	End Semester Examination

Category of Courses:

F	Foundation Course
C	Core Course
GE	Generic Elective
OE	Open Elective

BAS 3101 Matrices and Calculus **Credits: 4**

Course Objective:

The general objective of the course is to introduce

1. the concepts of matrix algebra, methods of solving system of linear equations and determine eigen values and eigen vectors of a matrix;
2. the concepts of the eigen values and eigen vectors of Hermitian, Unitary and Normal matrices differ from those of general matrices;
3. the concepts of derivatives of functions (one and several variables) and their applications;
4. the concepts of multiple integration, Beta, Gamma functions and their applications;
5. the concepts of vector calculus to expose students to mathematical applications.

Learning Outcomes:

Upon successful completion of the course, students will be able to

1. demonstrate ability to manipulate matrices, to find rank and to solve the system of linear equations;
2. find eigen values and eigenvectors and use them in diagonalization problems and other applications;
3. find nth derivative by using Leibnitz theorem;
4. apply partial derivatives to study extrema & expansion of functions of two variables;
5. evaluate double integrals by changing variables , changing order and triple integration to find the area and volume of given region;
6. calculate line integrals along piecewise smooth paths, interpret such quantities as work done by a force;
7. solve double and triple integrations and apply it to calculate line, surface and volume integrals;
8. apply Green's theorem to evaluate line integrals along simple closed contours on the plane, Stoke's theorem to give physical interpretation of the curl of a vector field and Divergence theorem to give physical interpretation of the divergence of a vector field.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Matrices** Type of Matrices, Elementary row and column transformation, Rank of matrix, Linear dependence, Consistency of linear system of equations and their solution, Characteristic equation, Caley-Hamiltion theorem, Eigen values and eigen vectors, Application of matrices to engineering problems.	30	1
II	**Differential Calculus** Leibnitz theorem, Partial differentiation, Euler's theorem, Expansion of function of several variables. Jacobian, Extrema of functions of several variables, Lagranges method of multipliers (Simple applications).	30	1

III	**Multiple Integrals** Double and triple integrals, Change of order, Change of variables, Beta and Gamma functions, Applications to area and volume, Dirichlet integral and applications.	30	1
IV	**Vector Calculus** Point function, Gradient, Divergence and Curl of a vector and their physical interpretations, Line, Surface and Volume integrals, Green's, Stoke's and Gauss divergence theorems (without proof) and applications.	30	1

Recommended Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advanced Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
4. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.

SYLLABUS

BAS-3102 ENGINEERING PHYSICS I

Course Objective:

The main objectives of the course are

1. To provide knowledge and develop an understanding of principles and processes of wave optics, optical communication and fundamentals of special theory of relativity.
2. To develop the basic skills to apply knowledge by the topics covered in the course to engineering problems.

Learning Outcome:

At the end of the course students shall be able

1. To apply knowledge of wave optics.
2. To design and conduct experiments.
3. To identify and solve the problems in different field of engineering & technology.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Wave Optics:** Interference: Interference of light, Biprism experiment, Displacement of fringes, Interference in thin film, Wedge shaped film, Newton's rings. Diffraction: Single slit and N-slit, Diffraction grating, Grating spectra, Dispersive power of grating, Rayleigh criterion and resolving power of grating. Polarisation: Double refraction, Nicolprism, Production and detection of plane, circularly and elliptically polarised light, Optical activity and Fresnel's theory of optical activity, Specific rotation and Polarimeter.	30	1
II	**Laser and Fibre Optics:** Laser: Spontaneous and stimulated emission of radiation, Einstein coefficient, Population inversion & pumping, Construction and working of ruby & He-Ne Laser, Applications of Laser, Holography. Fundamental idea about optical fibre, Propagation mechanism & communication in optical fibre, Types of optical fibre, Acceptance angle and acceptance cone, Numerical aperture	30	1

	and V-number, Attenuation ,Signal loss in optical fibre, Dispersion in optical fibre.		
III	**Special theory of Relativity:** Inertial & non inertial frames, Concept of ether, Michelson and Morley Experiment, Einstein's basic postulate of special theory of relativity, Lorentz transformation equations, length contraction, Time dilation, Mass variation, relativistic velocity addition theorem, Mass-energy Equivalence relation.	30	1

References:

1. Concepts of Modern Physics, Aurther Beiser , Mc-Graw Hill
2. Introduction of Special theory of relativity, Robert Resnick, Wiely
3. Optics, Ajay Ghatak, TataMc-Graw Hill
4. Optical fibre and Laser, Anuradha De, New Age
5. Fundamental of Physics, Resnick, Halliday & Walker, Wiely
6. Optics, Jenkin and White, Tata Mc-Graw Hill

(Dr. Karunesh Tiwari)
Convener

(Prof. Rajeev Manohar)
External Expert

(Dr. Nitin Jain)
Nominee

(Dr. Neelam Yadav)
Member

ENGINEERING MECHANICS (BME3101/BME3201)

Course Objective:

1. A working knowledge of statics with emphasis on force equilibrium and free body diagrams.
2. To calculate the reactive forces and analyse the structures.
3. To know the geometric properties of the different shapes & to learn energy and momentum methods.
4. Provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

Learning Outcome:

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

1. Solve the engineering problems in case of equilibrium and non- equilibrium conditions & solve the problems involving dry friction.
2. Calculate the reaction forces and forces in members of statically determinate structures.
3. Determine the centroid, centre of gravity and moment of inertia of various surfaces and solids &calculate the forces acting on the rigid body, structures using varying principles.
4. To find out the stress, strain and elastic properties of different bodies.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Two-Dimensional Force Systems:** Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position, Resultant of a force system, Simple Resultant of Two dimensional concurrent Force systems and Non-concurrent Force systems, Distributed force system, free body diagrams, Equilibrium and Equations of Equilibrium, Applications of two dimensional force system. **Friction**: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction, Equilibrium of bodies involving dry friction, Belt friction, Application of friction.	30	1

II	**Beam:** Introduction, Shear force and Bending Moment, Differential equations for shear force & bending moment, Shear force and Bending Moment Diagrams for Statically Determinate Beams. **Trusses:** Introduction, Simple Truss and Solution of Simple Truss, Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members	30	1
III	**Centroid and Moment of Inertia:** Introduction, Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area,Parallel Axes Theorem & Perpendicular axes theorem, Moment of inertia of composite bodies. **Kinematics and Kinetics:** Linear motion, Instantaneous center, D'Alembert principle, Rotation of rigid bodies, Impulse and momentum principle, Work and energy principle.	30	1
IV	**Simple Stress and Strain:** Definition of stress, stress tensor, normal and shear stresses in axially loaded members, Stress-strain relationship, Stress-strain diagram for uniaxial loading of ductile and brittle materials, Hooke's law, Poisson's ratio, shear stress, shear strain, modulus of rigidity, Relationship between elastic constants. One Dimensional Loading of members of varying cross-sections, Temperature Stresses,Strain energy.	30	1

Reference Books:

1. Engineering Mechanics by Irving H. Shames. Prentice-Hall.
2. Engineering Mechanics: Principles of Statics and Dynamics by R. C. Hibbler. Pearson Press.
3. Engineering Mechanics: by Shanes and Rao. Pearson Education.
4. Engineering Mechanics by S.S. Bhavikatti, K.G. Rajashekarappa, New Age Publications.
5. A textbook of Engineering Mechanics by Dr. R.K. Bansal, Laxmi Publications.
6. Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
7. Mechanics of Materials by E.P. Popov, Prentice Hall of India Private Limited.

SYLLABUS

BCS3101/ BCS3201 Foundation of Information Technology

Course Objective:

1. Introduce the fundamentals of computing devices and reinforce computer vocabulary, particularly with respect to personal use of hardware and software, the internet, network and mobile computing.
2. Study the basic concepts and functions of hardware and software.
3. Study the basic concepts and functions of operating system.
4. Study the basic concepts and functions of computer network.
5. Study the basic concepts and functions of Information Technology.
6. Study the basic concepts of C programming language.
7. Provide foundational or "Computer literacy" curriculum that prepares students for life-long learning of computer concept and skills.

Learning Outcome:

At the end of the course, the student should be able to:

1. Understanding organization of computer system and networking.
2. An ability to understand the basics of computer hardware and software.
3. Awareness of basic information security issues.
4. To understand the use of Information Technology in business.
5. To analyse and understand various types of software system.
6. An ability to understand operating system and its functions.
7. Ability to apply knowledge and practice on office tools to develop I.T application.
8. To analyse various computer networks.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Hardware and Software** Hardware, Software, Information technology, Types of computer: Mainframe computer, network computer, personal computer, laptop, personal digital assistant (PDA); Personal computer: Central processing unit (CPU), hard disk, common input or output devices, types of memory viz. RAM, ROM, peripheral device, computer performance. **Input Devices**: Mouse, keyboard, trackball, scanner, touchpad, light pen, joystick, digital camera and microphone. **Output Devices**: Monitors, screens, printers, plotters, speakers. **Input/output Devices**: Modems, Touch Screens. **Storage Devices**: Diskette, Zip disk, data cartridges, CD-ROM, internal, external hard disk: Disk formatting **Software:** Types Of Software: Operating systems software and application software, Software versions. Operating System: Functions and Types. Graphical User Interface (GUI), SDLC and its phases.	30 Hours	1

II	**Computer Network** Networks: LAN, WAN, client/server, sharing printers, applications, and files across a network. Intranet, Extranet, Internet and its uses, World Wide Web (WWW) The Telephone Network In Computing: Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), Asymmetric Digital Subscriber Line (ADSL), Analog and digital modem and transfer rate.	30 Hours	1
III	**Information Technology (IT)** Applications of IT: Applications in business such as: business administration systems, airline booking systems, insurance claims processing, online banking. Uses of large-scale computer applications in government such as: public records systems (census, vehicle registration), revenue collection, electronic voting. Applications in education such as: student registration and timetabling systems, computer-based training (CBT), distance learning, homework using the Internet. Electronic World: electronic mail, E-Commerce, concept of purchasing goods and services online, payment methods, advantages and disadvantages of purchasing goods and services online Health, safety and environment: Ergonomics, health issues, precautions, recycling printed outputs, recycling printer toner cartridges, using efficient monitor	30 Hours	1
IV	**Introduction to the C Language** Introduction to the C Language and its Advantages, C Program: Structure, Writing, Building an Executable Version, Debugging, and Running. Data Types and Variables, Operands, Operators, and Arithmetic Expressions, Control statements, use of while, for and do while loops, nesting loops and break, continue statement.	30 Hours	1

Text/Reference Books:

1. D. S. Yadav, "Foundations of Information Technology", New Age International Pvt. Ltd.
2. Silberschatz, Galvin and Gagne, "Operating Systems Concepts", Wiley Publication
3. D M Dhamdhere, "Operating Systems: A Concept based Approach", TMH
4. Yashavant P. Kanetkar, "Let us C", BPB

BEC3101/BEC3201 BASIC ELECTRONICS ENGINEERING

Course Objective:

This course provides

1. Comprehensive idea about basic electronics devices like Diodes, BJT, JFET, MOSFET, Operational Amplifier.
2. Fundamental principles of Electronic instruments like CRO and digital multi-meter.
3. Fundamental principle of communication.

Learning Outcome:

At the end of the course students will be able to gain knowledge about the

1. Fundamentals of electronic devices like Diodes, BJT, JFET, MOSFET, Operational Amplifier and Electronic instruments like CRO and digital multi-meter.
2. Number system, Boolean algebra, logic gates, Kaurnaugh map
3. Basics of communication systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**DIODES :** Energy band theory, Semiconductor material, Mass action law, PN junction: Forward and Reverse Bias characteristics, Diode as Rectifier: Half wave and Full wave Rectifiers, Breakdown Mechanism: Zener & Avalanche breakdown, Zener Diode and its application, LED, LCD, and Solar Cell.	30 Hours	1
II	**TRANSISTORS** Construction of Bipolar Junction Transistor: PNP and NPN, Working of Transistor, BJT configurations: CE, CB and CC, Input & Output characteristics of CB & CE configuration, Biasing: Fixed bias, Emitter bias, Potential divider bias, Comparison of biasing circuits. JFET: Basic construction and characteristics, Concept of pinch off, maximum drain saturation current. Input and transfer characteristics, Biasing: Self bias and fixed bias. MOSFET- Depletion and Enhancement type MOSFET- construction, operation and characteristics.	30 Hours	1
III	**DIGITAL ELECTRONICS AND COMMUNICATION SYSTEM** Number System, Complements, Boolean Algebra: Basic	30 Hours	1

	Theorems and De Morgan Theorems. Standard logic gates. Universal Logic Gates, Implementation of Boolean function using Basic gates and Universal gates. Reduction of Boolean function using K-Map upto4variables. Block Diagram of Communication System, Electromagnetic spectrum, Need for Modulation, Basic Definitions AM,FM,PM		
IV	**OPERATIONAL AMPLIFIER AND APPLICATIONS:** Introduction to OP-AMP, Characteristics of ideal OP-AMP. Basics of ideal and practical OP-AMP. Configurations: Open loop and closed loop, Applications of OP-AMP, Inverting amplifier, Non-inverting amplifier, Voltage follower, summing amplifier, Difference Amplifier, Integrator and Differentiator. Principle of oscillation and Barkhausen criterion.	30 Hours	1

Text Books:

1. Robert L. Boylestad and Louis Nashelsky Electronic Devices and Circuit Theory, Pearson India.
2. Kennedy. Electronic Communication System. TMH
3. Kalsi H.S, Electronic Instrumentation. TMH
4. M. Morris Mano, Digital Logic and Computer Design, PHI

Reference Books:

1. Jacob Millman, Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems (McGraw-Hill electrical and electronic engineering series).
2. William D. Cooper, Albert D.Hefrick, Modern Electronic instrumentation and measurement technique 5th edition Prentice Hall Of India, New Delhi 1997.
3. Ramakant Gaikwad .Op –Amp's & linear Integrated Circuits, 4th edition. Prentice Hall of India, New Delhi 2002.
4. Albert Paul Malvino, Donald P Leach . Digital Principle & Application 4th edition, Tata McGraw –Hill Edition . New Delhi -1991.

BAS 3104/BAS3204: ENVIRONMENTAL STUDIES

Course Objectives: The main objectives of the course are:

1. To create awareness and improve knowledge about environment.
2. To conserve natural resources through sustainable use.
3. To prevent, control of pollution and protect environment.
4. To developed skill and participation in environment protection activities.

Learning outcome: After the completion of the course, students are expected to better understanding of:

- Environments and related issues.
- Develop skill to solve many inter related problems of socio-economic nature and ecology.
- Able to conserve natural resources and sustainable use.
- Able to protect environment.

Course Contents:

Modules	Course Topics	Total Hours	Credit	Lecture/ week		
				L	T	P
1.	**Environment** Environment: Definition, Principles and Scope of Environmental Studies, Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere, Ecosystems, structure and function of ecosystem, Types of ecosystem, energy flow in an ecosystem, Food chain and food web, ecological pyramids, Prey-Predator interaction, Population dynamics of Prey and Predator. Material cycle: Definition and importance, Nitrogen and carbon cycle Environmental Impact Assessment (EIA): Definition and Concept, Elements of EIA, Prediction of impacts and its methodology, Sustainable Development. **Natural resource and its conservation** Natural resources: Renewable & non-renewable natural resources, drinking water quality, water borne and water induced diseases, arsenic and fluoride problem in drinking water, deforestation, impact of overexploitation mineral resources. Energy resources: Conventional and non-conventional energy sources, solar energy, hydro-power energy, Hydrogen-energy, wind energy, geothermal energy, biomass energy, nuclear energy, fossil fuels.	30	1	2	0	0

2.	**Environmental Pollution** Environmental pollution: Definition, pollutants, sources, causes, effects and control measures of air, water, and soil pollutions. Noise: Sources of noise pollution, measurement of noise, Noise exposure levels and standards. Impact of noise on human health. Noise control and abatement measures. Waste water and its treatment. Eutrophication and Biomagnifications. Solid waste management: solid waste source, characterization, effects and control measures of urban and industrial waste. **Current Environmental Issues** Current environmental Issues: Population growth, logistic curve equation. Climate change, global warming, acid rain, ozone layer depletion, Water Crises-Conservation of water, Rain water harvesting, Biodiversity and its conservation: Natural disaster and its management. Nuclear hazards Environment protection: Legal aspects of environment protection, Environment Protection Act, Air(Prevention and Control of Pollution)Act, Water(Prevention and control of Pollution)Act, Role of NGOs in environment protection. Environmental Education and Awareness.	30	1	2	0	0

Text Books:

1. Environmental Biology- Agarwal, K.C.2001, Nidi Publ. Ltd. Bikaner.

2. Basics of Environment and Ecology- A. Kaushik and C.P. Kaushik, Second Edition, 2014, New Age International(p) Ltd.

Suggested Readings:

1. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad-380013,India
2. Brunner R.C., Marine Pollution, Clanderson Pross Oxford (TB)
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ, House , Mumbai,1196p.
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd. Down to Earth, Centre for Science and Environment (R).

ENGINEERING MECHANICS LAB (BME3151/BME3251)

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel specimen.
2. To determine the compression test and determine the ultimate compressive strength for a Specimen.
3. To conduct the Impact-tests (Izod/Charpy) on Impact-testing machine to find the toughness.
4. To determine the hardness of the given specimen using Vickers/Brinell/Rockwell hardness testing machine.
5. Friction experiment(s) on inclined plane and/or on screw-jack.
6. Worm & worm-wheel experiment for load lifting.
7. Belt-Pulley experiment.
8. Bending of simply-supported and cantilever beams for theoretical & experimental deflection.
9. Torsion of rod/wire experiment.
10. Experiment on Trusses.
11. Statics experiment on equilibrium.
12. Experiment on Moment of Inertia.

Note:

1. At least ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list.

Remaining two experiments may either be performed from the above list or designed & set by the concern faculty as per the scope of the syllabus.

BCS3151/BCS 3251 Foundation of Information Technology Lab

1) Run basic DOS commands.
2) Learn the use of Word Processor.
3) Learn the use of Excel.
4) Prepare presentation on any topic of your choice.
5) Write a C program to find sum of two numbers.
6) Write a C program to learn the function of FOR loop.
7) Write a C program to learn the function of WHILE/ DO WHILE loop.
8) Write a C program for pattern printing
9) Write a C program to print Fibonacci series.
10) Write a C program to find factorial and reverse of a number.



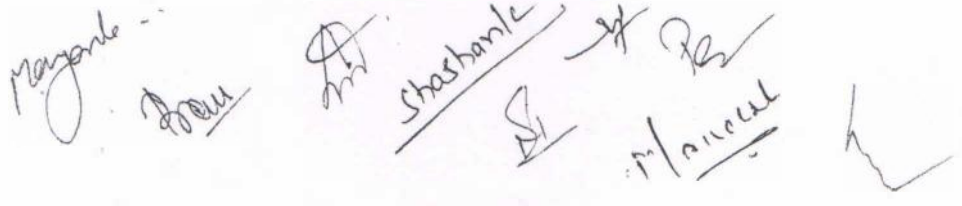
WORKSHOP PRACTICE (BME3152/BME3252)

1. **Carpentry Shop:** Study of tools & operations and carpentry joints, Simple exercise using jack plane, to prepare half-lap corner joint, mortise & tennon joints. Simple exercise on wood working lathe.
2. **Fitting Bench Working Shop:** Study of tools & operations, Simple exercises involving fitting work, make perfect male-female joint, Use of drills/taps idea.
3. **Black Smithy Shop:** Study of tools & operations, Simple exercises base on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.
4. **Welding Shop:** Study of tools & operations of Gas welding & Arc welding, Simple butt and Lap welded joints, Oxy-acetylene flame cutting.
5. **Sheet-metal Shop:** Study of equipment & operations, Making Funnel complete with 'soldering', Fabrication of tool-box, tray, electric panel box etc.
6. **Machine Shop:** Study of machine tools and operations, Plane turning, Step turning, Taper turning, Threading, grinding of turning equipment.
7. **Foundry Shop:** Study of tools & operations, Pattern making, Mould making with the use of a core, Method of material pouring and Casting.

Note:

1. At least ten experiments are to be performed in the semester.
2. At least eight experiments should be performed from the above list.

Remaining two experiments may either be performed from the above list or designed & set by the concern faculty as per the scope of the syllabus



BAS-3151*BAS-3252 PHYSICS PRACTICALS**

Course Objective:

The main objectives of the course are

1. To learn some basic principles of physics that help students to understand how the world around them works.
2. To realize fundamental concepts of physics and how it can be applied to other field i.e. engineering.
3. To apply scientific knowledge systematically.

Learning Outcome:

At the end of the end of the course students be able to

1. Tackle experimental problems in physics.
2. Use mathematics to describe the physical world.
3 Plan, execute, analyse and report experiments.
4. Compare results critically with prediction from theory.

The student shall perform ten experiments in the laboratory by choosing at least four experiments from each group

GROUP-A

Practical	Topics	Total Hours	Credits
1.	To determine the wavelength of monochromatic light by Newton's rings.	30	1
2.	To determine the wavelength of monochromatic light with the help of Fresnel's biprism		
3.	To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.		
4.	To determine the specific rotation of cane sugar solution using Bi-quartz polarimeter.		
5.	To determine the wavelength of various spectral lines using plane transmission grating		
6.	To study the polarization of light by simple reflection using laser.		
7.	Measurement of wavelength of a laser (He-Ne) light using single slit diffraction.		

*BAS3152

**PHYSICS-I LAB

As per Evaluation Scheme, SOE

GROUP-B

Practical	Topics	Total Hours	Credits
8	To determine the specific resistance of the material of given wire using Carey Foster's bridge	30	1
9	To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.		
10	To verify Stefan's Law by electrical method		
11	To calibrate the given ammeter and voltmeter		
12	To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall-effect set up.		
13	To determine energy band gap of a given semiconductor material.		
14	To study the characteristics of zener diode		
15	To determine electrochemical equivalent of copper using Tangent or Helmholtz galvanometer		
16	To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.		
17	To determine the ballistic constant of a ballistic galvanometer		
18	To determine the value of a planck's constant by a photocell.		
19	To determine the coefficient of viscosity of a liquid.		
20.	Measurement of fiber attenuation and aperture of fiber		

(Dr. Karunesh Tiwari
Convener

(Prof. Rajeev Manohar)
External Expert

(Dr. Nitin Jain)
Nominee

(Dr. Neelam Yadav)
Member

BABU BANARASI DAS UNIVERSITY, LUCKNOW

School of Engineering

Department of Electrical Engineering

Bachelor of Technology

SEMESTER – I / II

BEE3101/BEE3201 BASIC ELECTRICAL ENGINEERING

Course Objective:

1. This course provides comprehensive idea about circuit analysis.
2. The subject gives the knowledge about combinational circuits.
3. Subject gives the knowledge about the analysis and design of new electrical circuits.
4. Other logical working principles of machines and common Measuring instruments.

Learning Outcome:

At the end of the course students will be able.

1. To understand basic theorem of electrical engineering.
2. To understand basic electrical engineering.
3. To understand the basic concepts of magnetic, AC & DC circuits.
4. To explain the working principle, construction, applications of DC & AC machines & measuring instruments.
5. To gain knowledge about the fundamentals of electric components, devices.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Electric Circuit:** Introduction to linear and nonlinear circuits, circuit elements, various sources and source transformation, Star delta transformation, solution of D.C. circuits using Kirchhoff's laws- Mesh Analysis and Nodal Analysis, Signal wave forms, Passive elements specifications. **Basic theorems:** Thevenin, Norton, Maximum Power, Superposition, Millman's Theorem, Tellegen's Theorem applied to DC networks.	30 Hours	1
II	**A. C. Circuits:** A.C. voltage and currents, average and r.m.s. values, Form factor and peak factor, Phasor	30 Hours	1

	representation of sinusoidal quantities, phasor in polar, rectangular and exponential forms. Analysis of single phase series, parallel and series-parallel circuits, Active & reactive and apparent power, p.f., Volt-amperes, frequency response and Q-factor. Analysis of balanced three phase a.c. circuits, Introductory concept, voltage, current and power in three phase balanced circuits. Star-delta connections. Measurement of three phase power by Wattmeter Method.		
III	**Measuring Instruments & Electromagnetic and Transformer:** Types of instruments, construction, working principles & applications, PMMC, MI, Single phase dynamometer, Ammeter, Voltmeter, Wattmeter, Induction type Energy meter, Use of shunt and multiplier. Magnetic circuit concept, B-H curves characteristics of magnetic materials, Practical magnetic circuits. Magnetic circuits with D.C. and A.C. excitation, Hysteresis and eddy current losses, Magnetic force. Self and mutual inductances, Faraday`s laws, Lenz`s Law, Statically and dynamically induced emfs, Energy stored in magnetic fields. Principle of Transformer operation, emf equation, Equivalent circuit of transformer, Losses and efficiency, Introduction of Auto Transformer and its applications.	30 Hours	1
IV	**Electrical Machines:** Basic concepts of rotating electric machines, DC machines (motor and generator), working principle, types, EMF and torque equations characteristics and application of DC motor. Three phase induction motors, types, principle of operation, applications. Single phase induction motors, principle of operation, starting methods, applications. Synchronous machines (motor and generator), principle of operation and applications.	30 Hours	1

Text &Reference books:

1. 'Fundamental of Electric Circuits' by Charles K Alexander and Matthew N.O. Sadiku, Tata McGraw Hill Publication.

2. 'Electrical Engineering Fundamentals' by Vincent Del Toro, PHI Publication.
3. 'Electric Technology, by H.Cotton, CBS Publishers and Distributors.
4. 'Basic Electrical Technology' by A.E.Fitzgerald, McGraw Hill Publication.
5. 'Basic Electrical Technology' by Kothari and I.J. Nagrath, Tata McGraw Hill.
6. 'Basic Electrical Technology' by S.N.Singh, PHI Publication.

BASIC MECHANICAL ENGINEERING (BME3102/BME3202)

Course Objective:

1. To learn the basic principles of classical thermodynamics.
2. To apply the laws of thermodynamics to various systems and analyze the significance of the results.
3. To learn the basic concepts of internal combustion engines.

Learning Outcome:

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

1. Differentiate between closed and open systems and analyze related problems.
2. Apply the concept of first and second law to analyze thermodynamic systems.
3. Analyze the performance of IC engines and identify methods to improve the efficiency.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Fundamental Concepts and Definitions:** Definition of thermodynamics, Microscopic and Macroscopic approaches, Systems, surroundings and universe, Concept of continuum, Properties and state, Thermodynamic properties, Thermodynamic path, process and cycle, Thermodynamic equilibrium, Reversibility and irreversibility, Quasi static process, Work and heat, Zeroth law of thermodynamics, concept of temperature.	30	1
II	**First law of thermodynamics**: Thermodynamic processes, flow work, Joules' experiment, Internal energy and enthalpy, First law of thermodynamics applied to open systems, Steady flow systems and their analysis, Application of steady flow energy equation, Limitations of first law of thermodynamics, PMM-I. **Second law of thermodynamics:** Statement of second law, heat engine, heat pump and refrigerator, PMM- II, Efficiency of Carnot engine, Entropy, Clausius Inequality, definition of third law of thermodynamics.	30	1

III	**IC engines:** Classification of IC engines, engine terminology, Compression Ignition engines and Spark Ignition engines, Construction and working of two stroke and four stroke engines, Difference between SI and CI engines, difference between 2-stroke and 4-stroke engine, Efficiency of Otto cycle and diesel cycle. Boilers & Condensers **Boilers:** Steam generators-classifications, Working of fire-tube and water-tube boilers, Boiler mountings & accessories. **Condensers:** Classification of condenser, Air leakage, condenser performance parameters.	**30**	**1**

Reference Books:

1. P.K. Nag, Basic and Applied Thermodynamics, Tata McGraw-Hill Publishing Company Ltd.
2. Yunus A. Cengel and M.A. Boles, Thermodynamics: An Engineering Approach. Tata McGraw- Hill Publishing Company Ltd.
3. C.P. Arora,Thermodynamics, Tata McGraw- Hill Publishing Company Ltd.

SYLLABUS

(BAS 3103/BAS 3203) CHEMISTRY

Course Objective: The main objectives of course are:

1. To provide basic building blocks of engineering chemistry.
2. To provide spatial learning style using images, pictures, colors and models.
3. To provide the basic mathematical problems of polymer chemistry.

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

1. understand the role of chemistry in field of engineering.
2. understand the structure of atoms and apply the periodic laws to predict chemical and physical properties of the elements.
3. develop analytical capabilities and techniques of interpretation.
4. apply the knowledge in solving problems in their respective field of study.
5. employ critical thinking and efficient problem-solving skills in the four basic areas of chemistry (analytical, inorganic, organic, and physical).

Course Contents:

Module	Course contents	Total Hours	Credits
I	**Introduction to General Chemistry** Atomic structure, Chemical bonding: Significance of Quantum numbers, Shapes of s, p, d, and f atomic orbitals. Rules for filling electrons in various orbitals. Electronic configuration of atoms, Molecular Orbital Theory and its Applications in Homonuclear and Heteronuclear diatomic molecules. Reactions kinetics: Rate equation, Order and molecularity of reaction. Theories of reaction rates, Integrated rate equations. Electrochemistry: Nernst equation and its importance. Nanomaterials: Types of nanomaterial, Creation and use of Fullerenes. Carbon nanotube and its application. States of matter: Space lattice, Types of unit cell (cube), Density of unit cell, Defects in crystal. Liquid crystal and its application.	30	1

Shalini

Manisha

(Prof. V.P. Sharma)

II	**Mechanistic Concepts of Stereochemistry**: Concept of Isomerism, Types of Isomerism. Optical isomerism: Elements of symmetry, molecular chirality, optical activity, chiral and achiral molecules with two stereogenic centers. Properties of Enantiomers and Disasteromers. Relative and absolute configuration: Sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism: Determination of configuration of geometric isomers, E & Z system of nomenclature. Conformational isomerism: Conformational analysis of ethane and n-butane. Introduction to Green Chemistry, 12 principles of Green Chemistry.	30	1
III	**Titrimetric Analysis:** Introduction, Standard solutions, Equivalents and Normalities and Oxidation numbers, Indicators. **State of Art Analytical techniques** Nuclear Magnetic Resonance: Magnetic nuclei with special reference to ^{1}H. Chemical shift, Shielding and Deshielding. Ultraviolet Spectroscopy: Types of Transition, Chromophores and Auxochromes. Water treatment methods for boiler feed water by Zeolite method. Water treatment: Water Quality Monitoring and Management, Surveillance, Water effluent treatment and Relevant Standards and Regulatory Norms(IS:10500, IS 14543, IS 13428)	30	1
IV	**Principles of Polymer Chemistry** Introduction of Polymer: Classification of Polymers, Mechanism of addition polymerization, Thermoplastic and thermosetting resins, Molecular weight of polymers. Elastomers: Natural rubber, Buna-S, Buna-N, Butyl rubber. Synthetic Fibers: Nylon-6, Nylon 6, 6, Kevlor, Dacron. Organic conducting polymers: Polyacetylene, Polythiophene, Polypyrrole, Polyaniline. Biodegradable polymers.	30	1

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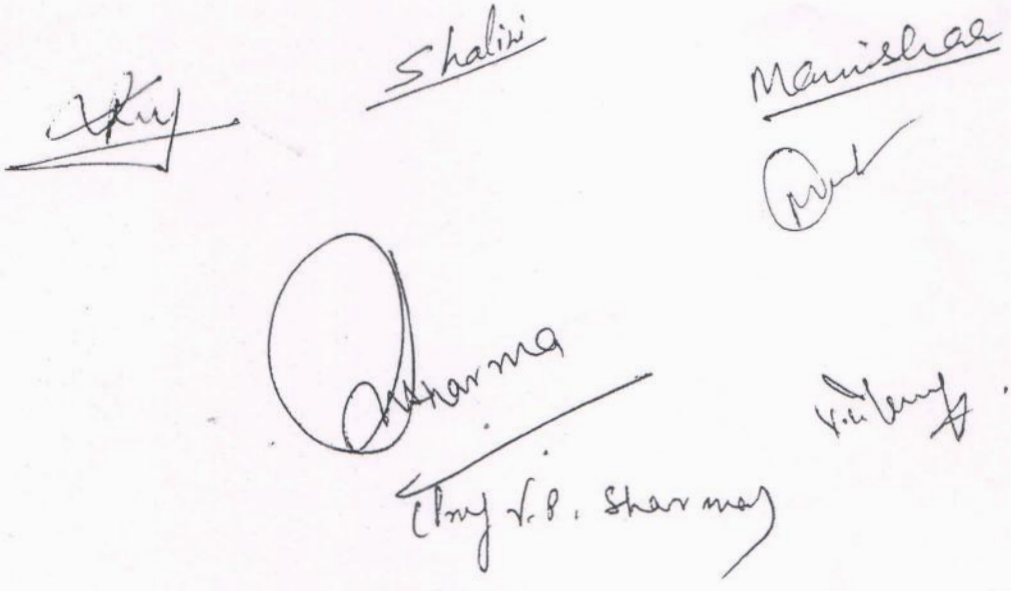
Text Book:

1. Shashi Chawla, A Text book of Engineering Chemistry,8th edition Dhanpatrai & Co(p) ltd,2013.
2. R.K. Agarawal: Engineering chemistry, 15th edition,Krishna publication media (P) Ltd.2014
3. I.L.Finar,Organic Chemistry,6th edition ,Pearson,2011
4. Clark, J. H. "Green chemistry: Challenges and opportunities". *Green Chemistry*.1999

Suggested Readings:

1. Arun Bahl and B.S. Bahl , Advanced organic chemistry,S.Chand,2010
2. R.T. Morrison, R.N. Boyd, S.K. Bhatacharjee, Organic Chemistry, 7thEdn, Pearson, 2011.
3. Charles P Poole, Frank J Owens, Introduction to Nanotechnology,John Wiley Sons,2007
4. Atkins P and de Paula J. Physical Chemistry (8th ed., W.H. Freeman 2006)



SYLLABUS

Course Title: Technical Communication **Course Code: BHS3101/3201**

Course Objectives:

- To make the students aware of the fundamentals of communication and its types and various levels;
- To train them techniques and methods of vocabulary building and paragraphs writing and make communication effective and impressive;
- To groom them expert in oral as well as written communication with the knowledge of various forms and formats;
- To make them understand the role of Nonverbal (Kinesics) in Communication
- To enhance their capacity for comprehension, creative and critical thinking;

Learning Outcome: The successful completion of the course students will be able to:

- Understand the meaning of communication and its various applications;
- Form and apply suitable vocabulary, phrases and sentences in communicating variety of situations;
- Able to use variety of forms/formats and techniques required in different levels of communication;
- Maintain congruity between verbal and nonverbal communication;
- Able to comprehend and clarify the intricacies of art of communication.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Fundamentals of Communication:** Communication: Definition, Nature, Origin, Scope, Features and Process of communication; Types of Communication: Verbal and Non-Verbal, Formal and Informal, Oral & Written Communication and technical and general Communication; Levels of Communication: Extra-personal, Intra-personal, Interpersonal, organisational, Grapevine, Group and Mass Communication; Language as a Tool of Communication; The Flow of Communication: Vertical (Upward and Downward), Lateral or Horizontal; Technical Communication: Definition, Distinction between Technical & General Communication, Importance of Technical Communication for Technocrats & Professionals; Barriers to Communication: definition; types: Physical, Semantic, Psychological barriers or Extra-personal, Intra-personal, Interpersonal, and Organizational barriers, How to Overcome these Barriers;	30	1
II	**Creativities in Communication** **Word Formation:** Affixation, Compounding, Blending,	30	1

10/6/19 10/6/19

	Conversion. Enriching **Vocabulary:** Synonyms, Antonyms, Homophones. Homonyms, One word Substitution, Foreign Words & Phrases; **Forms of Writing and Techniques:** Note taking, Reviewing. Interpreting, Paraphrasing and Précis Writing, Pre-Requisites of Good Sentences; Essentials of Good Sentences, Common Errors to be avoided **Requisites of Good Paragraph Writing:** Unity, Coherence, Clarity. Proper Length, Emphasis, Logical Sequencing, Development of Paragraphs; **Methods of Writing:** Inductive, Deductive, Chronological, Spatial. Comparison & Contrast, Question to Answer, Interruptive. Illustrative;		
III	**Business Communication** Principles. 7 C's of technical Communication; Formats of Business Letters; **Types of Letter:** Sales & Credit Letters, Inquiry. Quotation & Reply Letters, Letters for Placing & Fulfilling Orders, Complaint, Claim & Adjustment Letters; **Job Letters:** Cover letters, Resume **Reports:** Definition, Significance, Features & Purpose, **Types:** Formal . Informal, Periodic, Informational, Analytical; **Formats & Structures of Reports:** Letter Format, Memo Format. Printed Format, Manuscript Format; Writing of a Report Structure of Manuscript Format; **Proposals:** Definition, Significance, Features & Purpose; Types & Structures: Solicited & Unsolicited, Business, Research. Technical; Structure of Technical Proposals.	30	1
IV	**Presentation Strategies:** Purpose, Scope, Understanding Audience & Locale. Organizing contents, Audio-Visual Aids; **Modes of Presentation:** Manuscript, Impromptu, Memorization. Extempore; **Non-Verbal Dimensions of Communication:** **Kinesics:** Gesture. Posture, Facial Expression, Eye Contact; Paralinguistics. Proxemics, Haptics, Chronemics, Oculecsis. Group Discussion.Telephone Etiquettes,Dining Etiquettes, Interviews.Ice-Breaking.	30	1

Text books:

Minakshi Raman et al. Technical Communication, New Delhi: Oxford University Press, 2014.

Singh. R.P. Functional Skills in Language & Literature, New Delhi: Rupa, 2007.

Reference Books:

Sharma, Sangeeta et al. Communication Skills for Engineers and Scientists, New Delhi: PHI, New Delhi. 2009.

Shukla, Aditya. Professional Communication, Pune: Technical Publications, 2013.

10/6/19

10/6/19

BEE3151/BEE3251 BASIC ELECTRICAL ENGINEERING LAB

(Any 10 experiments)

1. Verification of KCL & KVL.
2. Verification of Thevenin's theorem.
3. Verification of Norton's theorem.
4. Verification of Superposition theorem.
5. Measurement of active and reactive power in 1-phase and Power Factor Improvement.
6. Measurement of active power in 3 -phase circuit using TWO wattmeter methods.
7. Study of transformer through assembling and polarity check.
8. Determination of equivalent circuit parameters of a single phase transformer by O.C. and S.C. tests and estimation of voltage regulation and efficiency at various loading conditions and verification by load test.
9. Study of dc shunt motor speed control using (1) Armature control (2) Field Control.
10. Determination of efficiency of DC shunts motor by load test.
11. Study of Electrical Equipment used in daily life.
12. Study of DC Machine.
13. Full wave rectifier circuit using diodes.
14. Transistor input-output characteristics.

ENGINEERING GRAPHICS LAB (BME3153/BME3253)

1. **Scales:** Representative factor, plain scales, diagonal scales, scales of chords.
2. **Projection:** Types of projection, orthographic projection, first and third angle projection.
3. **Projection of points:** The principle of orthographic projections of a point on HP and VP, Conventional representation, Projection of a point in all the quadrants.
4. **Projection of Lines**: Line inclined to one plane, inclined with both the plane, True Length and True Inclination, Traces of straight lines.
5. **Projection of planes and solids:** Projection of Planes like circle and polygons in different positions; Projection of polyhedrons like prisms, pyramids and solids of revolutions like cylinder, cones in different positions.
6. **Section of Solids:** Section of right solids by normal and inclined planes; Intersection of cylinders.
7. **Isometric Projections:** Isometric scale, Isometric axes, Isometric Projection from orthographic drawing.
8. **Perspective Projection:** Nomenclature of Perspective Projection, Method of drawing perspective views, Visual Ray Method, using Top and Front, Top and Side views.
9. **Computer Aided Drafting (CAD)-I:** Introduction, benefit, software's basic commands of drafting entities like line, circle, polygon, polyhedron, cylinders.
10. **Computer Aided Drafting (CAD)-II:** Transformations and editing commands like move, rotate, mirror, array; solution of projection problems on CAD.

Note:

1. At least ten experiments are to be performed in the semester.

2. At least eight experiments should be performed from the above list.

Remaining two experiments may either be performed from the above list or designed & set by the concern faculty as per the scope of the syllabus

Reference Books:

1. Computer Aided Engineering Drawing by S.Trymbaka Murthy, I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.

2. Engineering Graphics by K.R.Gopalakrishna, 32nd edition, 2005, Subash Publishers Bangalore.

BAS 3153/BAS3253 CHEMISTRY LAB

Course Objective: The main objectives of course are:

1. To Purify and identify organic compounds.
2. To calculate reaction yield for relevant lab experiments.

. **Learning objective:** Upon successful completion of this course, students will be able to:

1. identify the difference between scholarly/peer-reviewed research and practical information related to agriculture as well as information that is authoritative, unbiased, and timely.
2. apply the principles of teaching and learning in relation to practical chemistry laboratories and associated chemistry concepts.

Course Contents:

Module	List of Experiments	Total hours	Credit
1.	Determination of constituents and amount of alkalinity of supplied water sample.		
2.	Determination of total hardness of water by complexometric titration method.		
3.	Determination of chloride content in a given sample of bleaching powder		
4.	Determination of chloride content in supplied water sample using mohes method.	60	2
5.	Determination of iron content in the given water sample by using external indicator		
6.	Determination of pH of a solution using a pH meter and titration of such a solution phmetrically.		

Suggested Readings:

1. Textbook of practical chemistry, A.I. Vogel, Prentice Hall, 5th edition.
2. Vogels quantitative chemical analysis, A.I. Vogel, Prentice hall, 6th edition.
3. Practical organic chemistry, F.G. Mann & B.C. Saunders, orient longman,1960.

Shalini Sharma (Prof V.P. Sharma)

Manisha

BAS 3201 Differential Equations and Fourier Analysis **Credits: 4**

Course Objective:

The general objective of the course is to introduce

1. the formulation and solution of ordinary differential equations;
2. the concepts of series solution of differential equation and solution of Bessel's. Legendre's equations and their properties;
3. the concept of Fourier series expansion of functions and harmonic analysis;
4. the formulation and solution of partial differential equations arising in a number of practical problems;
5. the applications of partial differential equation in wave equations, heat flow and line transmission.

Learning Outcomes:

Upon successful completion of the course, students will be able to

1. identify an ordinary differential equation and its order and degree;
2. compute the general solution of 2nd order ordinary differential equations and apply them to solve the L-C-R circuits;
3. determine the general solution of higher order linear equations with constant coefficients;
4. determine whether a system of functions is linearly independent using the Wronksian;
5. use the method of reduction of order and undetermined coefficients to find a second linearly independent solution of a second order linear homogeneous equation when one solution is given;
6. use the method of variation of parameters to find particular solutions of second order, linear homogeneous equations;
7. use power series and Frobenius series method to solve differential equations;
8. expand periodic functions into Fourier series the knowledge of which is useful in signal processing;
9. determine the Fourier sine and cosine series for functions defined on an interval;
10. use the method of separation of variables to reduce some partial differential equations to ordinary differential equations;
11. solve quasilinear first-order partial differential equations using the method of characteristics and first integrals;
12. solve second-order hyperbolic partial differential equations by the travelling wave approach (D'Alembert's method of solution);
13. provide an application oriented computation for solving wave equation, heat equation and steady state two dimensional heat flow.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Differential Equations** Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solution of second order differential	30	1

	equation by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).		
II	**Series Solution and Special Functions** Series solution of ordinary differential equations of 2^{nd} order with variable coefficients (Frobenius Method), Bessel and Legendre equations and their series solutions, Properties of Bessel functions and Legendre polynomials.	30	1
III	**Fourier series** Periodic functions, Trigonometric series, Fourier series of period 2π, Euler's formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series. Harmonic Analysis.	30	1
IV	**Partial Differential Equations and its applications** Homogeneous Linear partial differential with constant coefficients, Non- Homogeneous Linear partial differential equation with constant coefficients. Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two-dimensions, Heat conduction equations up to two-dimensions, Equations of transmission lines.	30	1

Recommended Books:

1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Engineering Mathematics-II, Thomson (Cengage) Learning, 2007.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
4. R. K. Jain & S. R. K. Iyenger, Advance Engineering Mathematics, Narosa Publishing House, 2002.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2005.
6. C. Ray Wylie & Louis C. Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd. 2003
7. G. F. Simmons, Differential Equations, Tata McGraw-Hill Publishing Company Ltd. 1981.
8. C. Prasad, Advanced Mathematic for Engineers, Prasad Mudranalaya, 1996.
9. A. C. srivastava and P. K. Srivastava, Engineering Mathematics, Vol. II, PHI Learning Pvt. Ltd., New Delhi, 2011.

SYLLABUS

BAS-3202 ENGINEERING PHYSICS II

Course Objective:

The main objectives of the course are

1. To provide knowledge and to develop an understanding of Modern Physics.
2. To develop a scientific attitude at micro and nano scales of materials.

Learning Outcome:

At the end of the course students shall be able

1. To apply knowledge in developing advanced materials and devices.
2. To apply fundamental laws of electricity and magnetism in engineering.
3. To identify and solve applied physics problems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Fundamental of quantum Mechanics:** Wave particle duality, de-Broglie matter wave, Davission Germer experiment, Phase velocity and group velocity, Uncertainty principle and its applications, Wave function and its significance, Expectationvalue, Schrödinger wave equation and its significance, Particle in one dimensional box, Linear harmonic oscillator.	30	1
II	**Crystal Structure, X ray Diffraction & Electromagnetism:** Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Crystal structure of NaCl and diamond, Lattice planes and Miller Indices, Reciprocal Lattice, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer. Displacement current, Equation of continuity, Maxwell's equations (Integral and Differential forms), Poynting theorem and poynting vectors, EM-wave equation and its propagation characteristics in free space, non-conducting and in conducting media, Skin depth.	30	1

III	**Superconductivity and Nanotechnology:** Superconductors: Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Temperature dependence of critical field, Type I and Type II superconductors, BCS theory (Qualitative), High temperature superconductors and applications of super-conductors. Nano-Materials: Basic principle of nanoscience and technology, Structure; properties and uses of fullerene and carbon nanotubes, Synthesis of nanomaterials-chemical vapour deposition technique, pulse laser deposition technique, characterization techniques (XRD, SEM,AFM),. Applications of nanotechnology.	30	1

References:

1. Concept of modern physics, Auther Bieser, Tata Mc-Graw Hill
2. Solid state Physics, S.O. Pillai, New Age International
3. Solid State Physics, CharleKittal Seventh Ed. Wiley Eastren
4. Nanotechnolgy, Reached Booker& Earl Boisen, Welly PL
5. Introduction to Electrodynamics, David J. Griffith, PHI

(Dr. Karunesh Tiwari)
Convener

(Prof. Rajeev Manohar)
External Expert

(Dr. Nitin Jain)
Nominee

(Dr. Neelam Yadav)
Member

SEMESTER III									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BHS3301/ BHS3302	Industrial Psychology / Industrial Sociology	2	0	0	40	60	100	2
C	BAS3301	Complex Analysis and Integral Transforms	3	1	0	40	60	100	4
C	BEC3301	Digital Electronics	3	1	0	40	60	100	4
C	BEC3302	Semiconductor Materials & Analog Circuits	3	1	0	40	60	100	4
C	BEC3303	Electronics Measurements & Instrumentation	3	0	0	40	60	100	3
C	BCS3305	Programming in 'C'	3	1	0	40	60	100	4
Practical / Training / Project									
C	BEC3351	Digital Electronics Lab-I	0	0	2	40	60	100	1
C	BEC3352	Electronics Lab	0	0	2	40	60	100	1
C	BEC3353	Electronics Measurements & Instrumentation Lab	0	0	2	40	60	100	1
C	BCS3355	'C' Programming Lab	0	0	2	40	60	100	1
GP	GP3301	General Proficiency	-	-	-	100	-	100	1
		Total	17	4	8	500	600	1100	26

SEMESTER IV									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BHS3402/ BHS3401	Industrial Sociology / Industrial Psychology	2	0	0	40	60	100	2
C	BAS3401	Statistical and Numerical Techniques	3	0	0	40	60	100	3
C	BEC3401	Advance Analog Circuits	3	1	0	40	60	100	4
C	BEC3402	Computer Architecture and Organization	3	1	0	40	60	100	4
C	BEC3403	Signals and Systems	3	1	0	40	60	100	4
C	BEC3405	Fundamental of Network Analysis	3	1	0	40	60	100	4
Practical / Training / Project									
C	BEC3451	Advance Analog Circuits Lab	0	0	2	40	60	100	1
C	BEC3452	Computer Organization Lab	0	0	2	40	60	100	1
C	BEC3453	Electronics Workshop & PCB Lab	0	0	2	40	60	100	1
C	BEC3455	Network Lab	0	0	2	40	60	100	1
GP	GP3401	General Proficiency	-	-	-	100	-	100	1
		Total	17	4	6	500	600	1100	26

SEMESTER V									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BHS3501	Engineering and Managerial Economics	3	0	0	40	60	100	3
C	BEC3501	Analog Communication System	3	1	0	40	60	100	4
C	BEC3502	Microprocessor	3	1	0	40	60	100	4
C	BEC3503	Antenna and Wave Propagation	3	0	0	40	60	100	3
C	BEC3505	Control System	3	1	0	40	60	100	4
C	BEC3506	Electromagnetic Field Theory	3	1	0	40	60	100	4
Practical / Training / Project									
C	BEC3551	Communication Lab-I	0	0	2	40	60	100	1
C	BEC3552	Microprocessor Lab	0	0	2	40	60	100	1
C	BEC3555	Control System Lab	0	0	2	40	60	100	1
GP	GP3501	General Proficiency	-	-	-	100	-	100	1
		Total	18	3	8	500	600	1100	26

SEMESTER VI									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BHS3601	Industrial Management	3	0	0	40	60	100	3
C	BEC3601	Digital Signal Processing	3	1	0	40	60	100	4
C	BEC3602	Microwave Engineering	3	0	0	40	60	100	3
C	BEC3603	Digital Communication System	3	1	0	40	60	100	4
C	BEC3604	VLSI Technology	3	0	0	40	60	100	3
GE		Generic Elective - I	3	1	0	40	60	100	4
Practical / Training / Project									
C	BEC3651	Digital Signal Processing Lab	0	0	2	40	60	100	1
C	BEC3652	Microwave Engineering Lab	0	0	2	40	60	100	1
C	BEC3653	Communication Lab-II	0	0	2	40	60	100	1
C	BEC3654	Seminar	0	0	2	100	-	100	1
GP	GP3601	General Proficiency	-	-	-	100	-	100	1
		Total	18	3	8	560	540	1100	26

- The student needs to undergo a 4-6 weeks of industrial training that will be evaluated in the VIIth semester.

SEMESTER VII									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BEC3701	Optical Communication	3	1	0	40	60	100	4
C	BEC3702	Data Communication Networks	3	1	0	40	60	100	4
GE		Generic Elective-II	3	1	0	40	60	100	4
GE		Generic Elective-III	3	1	0	40	60	100	4
OE		Open Elective – I *	-	-	-	40	60	100	4
Practical / Training / Project									
C	BEC3751	CAD of Electronics Lab	0	0	2	40	60	100	1
C	BEC3752	Electronics Circuit Design Lab	0	0	2	40	60	100	1
C	BEC3753	Industrial Training Evaluation	0	0	2	100	-	100	1
C	BEC3754	Project – I #	0	0	2	100	-	100	1
GP	GP3701	General Proficiency	-	-	-	100	-	100	1
		Total	12	4	8	580	420	1000	25

* Student will opt anyone of the open elective from the list of open electives provided by the university.

Student need to submit an abstract for the project, select a guide and will complete at least 20% of the project work.

SEMESTER VIII									
Course Category	**Course Code**	**Course Title**	**Contact Hours**			**Evaluation Scheme**			**Credits**
			L	**T**	**P**	**CIA**	**ESE**	**Course Total**	
C	BEC3801	Wireless Communication	3	1	0	40	60	100	4
GE		Generic Elective-IV	3	1	0	40	60	100	4
GE		Generic Elective-V	3	1	0	40	60	100	4
OE		Open Elective – II**	-	-	-	40	60	100	4
Practical / Training / Project									
C	BEC3851	Project –II##	0	0	16	160	240	400	8
GP	GP3801	General Proficiency	-	-	-	100	-	100	1
		Total	9	3	16	300	300	900	25

** Student will opt anyone of the open elective from the list of open electives provided by the university. The opted subject should be different from the one selected in VIIth semester.

This is in continuation with project work started in VIIth semester. In this semester the student will complete the project.

List of Open Elective offered by Department of Electronics and Communication Engineering.

Course Category	Course Code	Open Elective	L	T	P
OE	OE33421	Nanotechnology	3	1	0

Generic Elective – I		
1.	GE33411	Microcontroller
2.	GE33412	Advanced Semiconductor Devices
3.	GE33413	Sensor and Transducer
4.	GE33414	Data Structure

Generic Elective – II		
1.	GE33421	Satellite Communication
2.	GE33422	Introduction to RADAR Systems
3.	GE33423	Introduction to Optoelectronics
4.	GE33424	Introduction to MATLAB

Generic Elective – III		
1.	GE33431	VLSI Design
2.	GE33432	Introduction to Wireless Sensor Network
3.	GE33433	Embedded System
4.	GE33434	Power Electronics

Generic Elective – IV		
1.	GE33441	Optical Networks
2.	GE33442	Internet of Things
3.	GE33443	Information Theory and Coding
4.	GE33444	Artificial Neural Network

Generic Elective – V		
1.	GE33451	Electronics Switching
2.	GE33452	Television Engineering
3.	GE33453	Micro-Electromechanical Systems
4.	GE33454	Introduction to Digital Image Processing

Babu Banarasi Das University, Lucknow
Department of Electronics & Communication Engineering
School of Engineering
Bachelor of Technology

Evaluation Scheme (w.e.f from session 2019-20)

Course Category	Semester								Total Credits	%age
	I	II	III	IV	V	VI	VII	VIII		
F	11	16							**27**	**12.91**
C	16	10	25	25	25	21	12	12	**146**	**69.85**
GE						4	8	8	**20**	**9.57**
OE							4	4	**8**	**3.83**
GP	1	1	1	1	1	1	1	1	**8**	**3.83**
Total	**28**	**27**	**26**	**26**	**26**	**26**	**25**	**25**	**209**	**100**

Credit Summary Chart

Discipline wise Credit Summary Chart

Course Category	Semester								Total Credits	%age
	I	II	III	IV	V	VI	VII	VIII		
Basic Sciences	12	10	4	3					**29**	**13.87**
Humanities & Social Sciences	4		2	2	3	3			**14**	**6.69**
Engineering Sciences	11	16							**27**	**12.91**
Professional Subject – Core			19	20	22	17	10	4	**92**	**44.01**
Professional Subject – Generic Elective						4	8	8	**20**	**9.57**
Professional Subject – Open Elective							4	4	**8**	**3.83**
Project Work, Seminar and/or Internship in Industry or elsewhere/GP	1	1	1	1	1	2	3	9	**19**	**9.09**
Total	**28**	**27**	**26**	**26**	**26**	**26**	**25**	**25**	**209**	**100**

BEC3101/BEC3201 BASIC ELECTRONICS ENGINEERING

Course Objective:

This course provides

1. Comprehensive idea about basic electronics devices like Diodes, BJT, JFET, MOSFET, Operational Amplifier.
2. Fundamental principles of Electronic instruments like CRO and digital multi-meter.
3. Fundamental principle of communication.

Learning Outcome:

At the end of the course students will be able to gain knowledge about the

1. Fundamentals of electronic devices like Diodes, BJT, JFET, MOSFET, Operational Amplifier and Electronic instruments like CRO and digital multi-meter.
2. Number system, Boolean algebra, logic gates, Kaurnaugh map
3. Basics of communication systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**DIODES :** Energy band theory, Semiconductor material, Mass action law, PN junction: Forward and Reverse Bias characteristics, Diode as Rectifier: Half wave and Full wave Rectifiers, Breakdown Mechanism: Zener & Avalanche breakdown, Zener Diode and its application, LED, LCD, and Solar Cell.	30 Hours	1
II	**TRANSISTORS** Construction of Bipolar Junction Transistor: PNP and NPN, Working of Transistor, BJT configurations: CE, CB and CC, Input & Output characteristics of CB & CE configuration, Biasing: Fixed bias, Emitter bias, Potential divider bias, Comparison of biasing circuits. JFET: Basic construction and characteristics, Concept of pinch off, maximum drain saturation current, Input and transfer characteristics, Biasing: Self bias and fixed bias. MOSFET- Depletion and Enhancement type MOSFET- construction, operation and characteristics.	30 Hours	1
III	**DIGITAL ELECTRONICS AND COMMUNICATION SYSTEM** Number System, Complements, Boolean Algebra: Basic	30 Hours	1

	Theorems and De Morgan Theorems, Standard logic gates, Universal Logic Gates, Implementation of Boolean function using Basic gates and Universal gates, Reduction of Boolean function using K-Map upto4variables. Block Diagram of Communication System, Electromagnetic spectrum, Need for Modulation, Basic Definitions AM,FM,PM		
IV	**OPERATIONAL AMPLIFIER AND APPLICATIONS:** Introduction to OP-AMP, Characteristics of ideal OP-AMP, Basics of ideal and practical OP-AMP, Configurations: Open loop and closed loop, Applications of OP-AMP, Inverting amplifier, Non-inverting amplifier, Voltage follower, summing amplifier, Difference Amplifier, Integrator and Differentiator. Principle of oscillation and Barkhausen criterion.	30 Hours	1

Text Books:

1. Robert L. Boylestad and Louis Nashelsky Electronic Devices and Circuit Theory, Pearson India.
2. Kennedy, Electronic Communication System, TMH
3. Kalsi H.S, Electronic Instrumentation, TMH
4. M. Morris Mano, Digital Logic and Computer Design, PHI

Reference Books:

1. Jacob Millman, Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems (McGraw-Hill electrical and electronic engineering series).
2. William D. Cooper, Albert D.Hefrick, Modern Electronic instrumentation and measurement technique 5th edition Prentice Hall Of India, New Delhi 1997.
3. Ramakant Gaikwad .Op –Amp's & linear Integrated Circuits, 4th edition, Prentice Hall of India, New Delhi 2002.
4. Albert Paul Malvino, Donald P Leach , Digital Principle & Application 4th edition, Tata McGraw –Hill Edition , New Delhi -1991.

BEC3301 DIGITAL ELECTRONICS

Course Objective:

1. Learning codes used in digital circuits and study gate and minimization of logical expressions.
2. Learning of combinational circuits design and logic families of digital circuits.
3. Learning of Flip Flops, sequential circuits design analysis and synthesis of synchronous circuits and state machine design.
4. Learning of semiconductor memory, Hazard in digital circuits and design of Algorithm State Machine.

Learning Outcome:

1. Students will be able to minimize logic circuits and have knowledge of different types of gate and number system.
2. Students will be able to design Combinational circuits and have knowledge of different logic family circuits.
3. Students will have knowledge of Flip Flops and they can design sequential circuits.
4. Students will have knowledge of semiconductor memories, hazards occurs in digital circuits and design of algorithm state machine.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Number system and Boolean Algebra:** Review of number system, Signed Binary numbers, BCD code, Excess-3 code, Gray code, Review of Boolean Algebra, Logic Gates, Logic implementation using NAND and NOR gate, Canonical and standard form of Boolean function, Logic minimization: Karnaugh map simplification, don't care condition, Tabulation method.	30 Hours	1
II	**Combinational circuits and Logic Families:** Design procedure of combinational circuit: Half adder and Full adder, Half subtractor and Full subtractor, Binary Adder, Decimal Adder, Magnitude Comparator, Encoder and Decoder, Multiplexer and Demultiplexer,	30 Hours	1

	Logic Families: Transistor inverter, RTL, Diode logic, DTL,TTL, Brief introduction to DCTL,I^2L,HTL,ECL and MOS logic.		
III	**Sequential Circuits:** Flip-flops: SR, JK, D and T, Master slave FF, Registers: Buffer registers, shift registers, Counters: Asynchronous and synchronous counters, Basic models of sequential M/C, Analysis of asynchronous and synchronous circuits, Synthesis of completely and incompletely specified synchronous sequential M/Cs, State M/Cs.	30 Hours	1
IV	**Interface circuits:** Memories, PLD, RAM, ROM, Hazards. Algorithm State Machine design with example, Asynchronous sequential logic.	30 Hours	1

Text Books:

1. M. Morris Mano, "Digital Logic Design", PHI
2. S. Salivahanan& S. Arivazhagan, "Digital Circuits and Design", Vikas Publishing.

Reference Books:

1. Malvino & Leach, "Digital Principles and Applications", TMH.
2. R.P. Jain, "Modern Digital Design", TMH.
3. Ronald J Tocci , "Digital Systems, Principles and Applications", PHI.
4. Taub & Schilling, "Digital Integrated Electronics", TMH.

BEC3302 SEMICONDUCTOR MATERIALS AND ANALOG CIRCUITS

Course Objective:

1. To understand physical operation of basic semiconductor devices like BJT, JFET, MOSFET etc.
2. To understand DC and AC models of semiconductor devices.
3. To apply concepts of DC and AC modelling of semiconductor devices for the design and analysis.

Learning Outcome:

At the end of this course, the students will be able to understand the following points:

1. The voltage current characteristics of semiconductor devices like diode, BJT etc.
2. Relate dc and ac models of semiconductor devices with their physical operation.
3. Design and analysis of electronic circuits like CB,CE amplifiers.
4. Design analog system and components.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Semiconductor Material Properties And Special diodes:** Review of Fundamentals of Semiconductors, Charge Carrier in semiconductors, Carrier concentration in an intrinsic semiconductor, Junction properties.Metal Semiconductor Junction: Rectifying Contact and Ohmic Contact, Hetero-junctions. Special diodes**:** Tunnel diode, Varactor diode, Schottky diode, Photo diode, Photodetector.	30 Hours	1
II	**Diode circuits& Power Supply:** Ideal and Practical diode, Power Supply: Block diagram of Power Supply, Half wave Rectifier and Full wave Rectifier, Clipper, Clamper, Filter circuits, Voltage regulation, Voltage regulation using shunt & series regulator circuits ,Voltage regulation using IC.	30 Hours	1

III	**BJT Amplifiers** BJT Working and Operations**,** Biasing circuits**,** BJT models**:** Ebersmoll model**,** The "r_e" model of transistor**,** Analysis of transistor amplifier using h- parameters, BJT amplifier : CE,CB,CC configuration**,** Midband analysis of small signal amplifiers**,** Frequency response of Amplifier**.** Multistage Amplifier**,** Power Amplifier, Tuned Amplifier.	30 Hours	1
IV	**FET Amplifiers:** Operation, working and characteristics, Analysis and design of different biasing circuits for FET amplifiers. Small-signal model of FET: CS, CG, CD configuration, Low-frequency & High-Frequency analysis of CS, CG and CD amplifiers.MOSFET: Basic Structures, Working &Characteristics, MOSFET Biasing: Fixed bias, Self bias and Voltage divider bias.	30 Hours	1

Text books:

1. Boylestad & Neshelsky, "Electronic Devices & Circuits", 10thEd, PHI.
2. Streetman & Banerjee, "Solid State Electronics Devices", PHI.

Reference Books:

1. Adel S. Sedra& Kenneth C. Smith, "Microelectronic Circuits", Oxford.
2. Millman & Halkias, "Electronic Devices And circuits", TMH.
3. Salivahanan, Kumar &Vallavaraj, "Electronic Devices & Circuits", TMH.

BEC3303 ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Course Objective:

1. To understand basic principle and working of sensors and transducers.
2. To understand various components used in Electronic Measurement.
3. To understand principles of advanced electronic instruments.
4. To understand the application of electronics parameters in measurements.

Learning Outcome:

1. Students will learn measurement of physical parameters using transducers such as inductive, resistive, capacitive etc.
2. Students will learn principle and working of various sensors like piezoelectric, thermoelectric and photoelectric.
3. They will become familiar with basics of instruments and details of operation of measuring instruments and their applications.
4. They will become familiar with operation, controls and measurements using CRO.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Theory of Measurement:** Introduction to Measuring Instrument And Systems, Characteristics of Instruments (Static and Dynamic Characteristics). Error analysis: Sources, Types of Errors, Statistical analysis of Random errors. Instrument Calibration: Direct and Indirect Comparison Method, Sensors and Transducers, Passive transducers: Resistive, Inductive and Capacitive, Active transducers: Thermoelectric, piezoelectric & photoelectric, Bridges: AC bridges and DC bridges, Q meter.	30 hours	1
II	**Analog Meter & Digital Meter** Classification**,** Operating Forces**,** Constructional Details**,** Types of supports**,** Balancing Torque/Weight ratio**,** Deflecting Systems**,** Control Systems**,** Damping Systems**,** Galvanometers**:** Dynamic behavior of galvanometer**,** PMMC instrument, Ammeters, Voltmeter and Ohmmeter, Electrodynamometer Instruments, multi-meter. Analog to digital converter, A/D Conversion techniques and its characteristics.	30 Hours	1

	Digital to analog converter, D/A conversion techniques, characteristics and its conversion.		
III	**Oscilloscopes & RF Measurements-** Cathode ray oscilloscope**:** Block diagram of CRO**,** Specifications and controls**,** Sweep modes and Role of delay line, Single and Dual-beam CRO, Dual-trace CRO**,** Chop and alternate modes**,** Measurement of voltage, frequency time & phase. High frequency measurements – RF impedance. Types of oscilloscopes: Analog Storage Oscilloscope and Digital Storage Oscilloscope, Signal Generators: Sine-wave generator and Non- sinusoidal, Function generators, Frequency synthesis techniques, Digital signal generators, Signal Analyzers : Distortion, Wave and Network spectrum analyzer	30 Hours	1

Text Books

1. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai.
2. David A. Bell, "Electronic Instrumentation and Measurements", 2nd Ed., PHI.

Reference Books

1. Albert D. Helfrick, William David Cooper, "Modern electronic instrumentation and measurement techniques", TMH.
2. Oliver Cage, "Electronic Measurements and Instrumentation", TMH.
3. Alan S. Morris, "Measurement and Instrumentation Principles", Elsevier (Buterworth Heinmann), 2008.
4. H.S. Kalsi, "Electronics Instrumentation", TMH Ed.
5. MMS Anand, "Electronic Instruments & Instrumentation Technology", PHI Pvt. Ltd., New Delhi Ed.

BEC3351 DIGITAL ELECTRONICS LAB- I

Note: Minimum of 8 experiments is to be performed from the following list:

1. Study of different basic digital logic gates and verification of their Truth Table.
2. Study and verification of the law of Boolean algebra and De-Morgan's Theorem.
3. Construction and verification of various combinational circuits such as Half Adder, Full Adder, Half Subtrator and Full Subtractor.
4. Study of Different Code Converters, Encoder, Decoder.
5. Study of Magnitude Comparator.
6. Study of Multiplexer and De-multiplexer.
7. Construction and verification of various types of Flip-Flops using gates and IC's.
8. Construction and Verification of different Shift Registers.
9. Construction and verification of different types of Counters.
10. Study of important TTL technologies, Verifications of important TTL Circuit Parameters.

BEC3352 ELECTRONICS LAB

Note: Minimum of 8experiments is to be performed from the following list:

1. Diode Characteristic
    a) PN junction diode Characteristics, Static and Dynamic resistance measurement from graph.
    b) To plot Zener diode Characteristics curve.
2. Clipper Clamper
    a) To plot the Characteristics curve of various clamper circuits.
    b) To plot the Characteristics curve of various clipper circuits.
3. Half wave, full wave & bridge rectifier
    a) To measure V_{rms}, V_{dc} for half wave, full wave & bridge rectifier.
    b) To measure ripple factor, ratio of rectification for full wave & half wave rectifier.
4. Voltage regulation using zener diode shunt regulator and transistor series voltage regulator in the following cases
    a) Varying input
    b) Varying load
5. Characteristic of BJT
    a) To plot the input-output Characteristics curve in CB & CE configuration
    b) To find α&β and Q point from the above curve.
6. h- Parameter
    To measure h- parameter (A_v, A_i, R_o&R_i) in CE Amplifier
7. Multi Stage Amplifier
    a) To plot the Characteristics curve for Direct Coupled Amplifier.
    b) To plot the Characteristics curve for RC Coupled Amplifier.
    c) To plot the Characteristics curve for transformer Coupled Amplifier.
8. FET Characteristic
    a) To plot the Characteristics curve for n channel – JFET in CS configuration.
    b) To find out pinch off voltage from the above characteristics curve.
9. Op-Amp parameters measurement.
10. Power Amplifier
    a) Study of class A power Amplifier.
    b) Study of class B complementary symmetry Amplifier.

BEC3353 ELECTRONICS MEASUREMENTS & INSTRUMENTATION LAB

Note: Minimum of 8 experiments is to be performed from the following list:

1. Calibration of AC Voltmeter and AC Ammeter.
2. Characteristics of LVDT.
3. Measurement of unknown resistance by Wheatstone bridge and bridge sensitivity.
4. Measurement of low resistance using Kelvin's double bridge.
5. Measurement of capacitance by DeSauty's and Schering Bridge.
6. Measurement of Inductance by Anderson's Bridge and Maxwell's Bridge.
7. Measurement of Inductance by Hay's Bridge.
8. Study of L.C.R. Bridge and determination of the value of the given components.
9. Study of semiconductor diode voltmeter and its uses as DC average responding AC volt meter.
10. Measurement of Power & Power factor.
11. A/D & D/A converters.
12. Measurement of phase difference and frequency using CRO (Lissajous Pattern).

BEC3401 ADVANCE ANALOG CIRCUITS

Course Objective:

1. To provide knowledge about advance analog electronic circuits.
2. To know the basic concept of feedback and Oscillator circuits.
3. To know the application of op amp as filters and other non linear applications.
4. To know the design of op amp based circuits and timer IC 555.
5. To know the differential amplifier and current mirror circuits and PLL.

Learning Outcome:

Students will acquire knowledge of

1. Feedback circuits and oscillator circuit.
2. Filter design and op amp based nonlinear circuit design.
3. Op Amp based circuit design and timer IC 555.
4. Differential amplifier and current mirror circuits as well as PLL.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Feedback Amplifiers and Oscillators Circuits:** Feedback concept**,** Feedback connection type**,** Effect of feedback on Gain, Input impedance, Output Impedance Oscillator: Oscillation Operation**,** Phase shift Oscillator**,** Wien Bridge Oscillator**,** Tuned Oscillator Circuit**,** Colpitts Oscillator and Hartley Oscillator, Crystal Oscillator.	30 Hours	1
II	**Op Amp linear and Nonlinear application:** Review of Operational Amplifier, Voltage to Current and Current to Voltage converters. Filters: First order and Second order Low pass and High pass filters, Band pass filters, Band reject filters, All pass filters. Non linear circuit: Log Amplifier, Anti-Log Amplifiers, Temperature compensated log and antilog amplifiers, Analog Multipliers and their applications	30 Hours	1

III	**Comparator, Multivibrator and IC 555 Timer:** Zero crossing detector, Schmitt Trigger, Comparator, Precision Rectifiers and Peak Detectors, Sample and Hold Circuits, Generation of square and triangular waveforms, Astable multivibrator, Triangular waveform generator, Monostable multivibrator, Integrated Circuit Timer: The 555 Circuit, Monostable Multivibrator and astable multivibrator using the 555 IC.	30 Hours	1
IV	**Analog integrated circuit design and PLL (IC-565)** Current Mirror using BJT and MOSFET, Simple current mirror, Cascode Mirror, A Bipolar mirror with base current compensation, Wilson current mirror, Widlar current source, Darlington connection, Differential Amplifier, The MOS differential pair, Small signal operation of the MOS differential pair, The BJT differential pair, Other Non-ideal characteristics of the differential amplifier, Phase locked loops (PLL): Ex-OR Gates and multipliers as phase detectors, Block Diagram of IC PLL, Working of PLL and Applications of PLL	30 Hours	1

Text Books:

1. Boylestad & Neshelsky, "Electronic Devices & Circuits", 10th Ed, PHI.
2. Adel S. Sedra , Kenneth Carless Smith, "Microelectronic Circuits", Oxford University Press
3. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuits", PHI

Reference Books:

1. Millman & Hailkias, "Electronic Devices and Circuits", TMH.
2. Salivahanan, Kumar & Vallavaraj, "Electronic Devices and Circuits", TMH
3. R.P. Jain, "Modern Digital Design", TMH.
4. D. Roy Chaudhary, Shail Jain, "Linear integrated circuits", New Age International.

BEC3402 COMPUTER ARCHITECTURE AND ORGANISATION

Course Objective:

1. To understand von Neumann architecture and micro operations.
2. To understand register transfer and computer arithmetic.
3. To understand programming and instruction formats.
4. To understand memory organization and pipelining.

Learning Outcome:

1. Students will learn basic of computer.
2. Students will learn micro operations and computer arithmetic.
3. Students will learn about organization and interrupts.
4. Students will learn about memory organization and pipelining.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Basics of computer** Introduction to Computers: Basic of Computer, Von Neumann Architecture, Generation of Computer, Classification of Computers, Instruction Execution, Register Transfer, Bus and Memory Transfer, Tree-State Bus Buffers, Memory Transfer, Micro-Operations: Register Transfer Micro-Operations, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations.	30 Hours	1
II	**Computer arithmetic** Computer Arithmetic: Addition And Subtraction With Signed-Magnitude, Multiplication Algorithm, Booth Multiplication Algorithm, Array Multiplier, Division Algorithm, Hardware Algorithm, Divide Overflow, Floating-Point Arithmetic Operations, Basic Considerations, Register Configuration, Addition And Subtraction, Decimal Arithmetic Operations, BCD Adder, BCD Subtraction.	30 Hours	1

III	**Programming, Organization of computer** Programming the basic computer, Machine language, Assembly language, Assembler, First pass, Second pass, Organization of a Computer: Central Progressing Unit (CPU), Stack Organization, Register Stack, Memory Stack, Reverse Polish Notation, Instruction Formats: Three- Address Instructions, Two – Address Instructions, One- Address Instructions, Zero-Address Instructions, RISC Instructions, Addressing Modes Reduced Instruction Set Computer, CISC Characteristics RISC Characteristics. Input-Output Organization: Modes Of Transfer, Priority Interrupt, DMA, Input-Output Processor (IOP), CPUIOP Communication.	30 Hours	1
IV	**Memory organization, Pipelining** Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Cache Memory, Virtual Memory, Address Space and Memory Space, Associative Memory, Page Table, Page Replacement, Parallel Processing and Vector Processing: Pipelining, Parallel Processing, Pipelining General Consideration, Arithmetic Pipeline Instruction Pipeline, Vector Operations, Matrix Multiplication, memory Interleaving.	30 Hours	1

Text book:

1. M Morris Mano, “Computer System Architecture” PHI 3rd Edition

Reference Books:

1. John P Hayes “Computer Architecture and Organisation” McGraw Hilll 3rd Edition.
2. Modern Digital Design, R.P. Jain, TMH.
3. Digital Logic Design, M. Morris Mano, PHI
4. Digital Technology, Virendra Kumar, New Age.

BEC3403 SIGNALS AND SYSTEMS

Course Objective:

1. Coverage of continuous-time (CT) and discrete-time (DT) signals and systems, their properties, representations and methods of analysis.
2. Knowledge of frequency domain representation and analysis using Fourier transform.
3. Concept of sampling and reconstruction of signals.
4. Mathematical and computational skills such as convolution, correlation and spectral density needed in application areas like communication and signal processing.

Learning Outcome:

At the end of this course, the students will be able to understand the following points:

1. To characterize and analyze the properties of CT and DT signals and systems.
2. To analyze CT and DT systems in Time domain.
3. To represent CT and DT systems in the Frequency domain using Fourier Analysis- CTFT and DTFT.
4. To conceptualize the effects of sampling and reconstruction of CT signal.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction of Signals and Systems** Definition, representation and Classification of signals: continuous time (CT)& discrete time (DT) signals, Even & odd signals, Periodic & aperiodic signals, Random & deterministic signals, Energy & power signals, One & multidimensional signals, Some standard signals. Basic Operations on Signals for CT/DT signal, Transformation of independent & dependent variables, Definition of system and their classification: Continuous time & discrete time systems, Linear & non-linear systems, Variant &non-variant systems, Causal & non-causal systems and Static & dynamic systems.	30 Hours	1
II	**Linear Time- Invariant Systems** Introduction of LTI system , Convolution for CT and DT		

	signals, Impulse Response representation for LTI Systems, Properties of Impulse Response representation for LTI Systems**,** Differential and Difference Equation representations for LTI Systems**,** Properties of convolution, System interconnection.	30 Hours	1
III	**Fourier Transform Representation for Signals** Continuous Time Fourier transform (CTFT): Definition, Existence of Fourier Transform (FT)- Dirichlet Condition, Inverse Fourier transform, Properties of Fourier Transform, Fourier Transform Representations for Periodic Signals, Relation between Laplace Transform& Fourier Transform, Discrete Time Fourier Transform (DTFT): Definition, Existence of DTFT, Comparison between CTFT & DTFT, Properties of DTFT, Parseval's theorem or Rayleigh's Theorem, Sampling and Reconstruction of Continuous-Time Signals, Filtering and Signal Distortion: Time Response and Frequency Response, Linear Distortion and Equalization, Nonlinear Distortion, Ideal Low-Pass Filters, Phase Delay and Group Delay.	30	1
IV	**Spectral Density and Correlation** Spectral Density: Introduction, Energy Spectral Density, Power Spectral Density. Correlation: Correlation of Energy Signals, Correlation of Power Signals, Autocorrelation & Cross correlation and their Properties. Introduction to Noise, Types of Noises, Noise equivalent bandwidth, White Noise.	30	1

Text Books:

1. Simon Haykin, "Signals and Systems", John Wiley.
2. Simon Haykin, "Analog and Digital Communications", John Willey.

Reference Books:

1. H P Hsu, "Signals and Systems-Schaum's Outlines", TMH.
2. Bruce Carlson, "Signals and Systems", TMH.
3. Oppenheim &Wilsky, "Signals & Systems", PHI.
4. Taub and Schilling "Principles of communication signals", 2nd ed. New York: Mcgraw-Hill, 1986.

BEC3405 Fundamental of Network Analysis

Course Objective:

1. To give the students a fair knowledge on the working of networks analysis.
2. To give the students a strong concept regarding synthesis.
3. The subject gives the knowledge about different electrical networks.
4. Can examine about different networks and synthesis.

Learning Outcome:

At the end of the course, student should be able:

1. To analyze the basic concept of electrical networks.
2. Introduction to different networks theorem
3. Concepts of coupled circuits and transient analysis.
4. Introduction to two port and different types of network realization function.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Signal Analysis, Complex Frequency, General Characteristics and Descriptions of Signals, Node Voltage Analysis, Mesh Current Analysis, Review of Laplace Transforms, Poles and Zeroes, Initial and Final Value theorems, Superposition Theorem, Thevenin's and Norton's theorems, Maximum Power Transfer Theorem, Network functions.	30	1
II	Graph Theory fundamentals, Matrix Representation of Graphs, Formulation of Network Response Equations using Incidence Matrix, Duality in Networks. Computation of Ladder and Non-Ladder Networks, Routh-Hurwitz Stability Criterion, Bode Diagrams	30	1
III	Parameters of Two Port Networks, Correlation between Two Port Parameters, Two Port, Relation between Port Parameters, Transfer Functions using Two Port Parameters, Interconnection of Two Ports , Reciprocal and Symmetric Networks, Terminated Two Port Networks, Interconnections of Two Port Networks, Image Impedance, Iterative Impedance. Harmonics and Dirichlet`s Conditions, Waveform Symmetry and Fourier Coefficients. Filter Networks.	30	1

IV	Active Network Synthesis and Realizability: Elements of Relizability Theory, Hurwitz Polynomial, Positive Real Functions (PRF), Characteristics of PRF, Methodology for Simple Network Synthesis, Synthesis of Two Element Type One Port Network.	30	1

Text Books:

1. Franklin F. Kuo, “Network Analysis and synthesis”, Wiley India Pvt Ltd.
2. MS Sukhija, T.K. Nagsarkar, “Circuits and Networks”, Oxford University Publication.

Reference Books:

1. ME Van Valkenberg, “Network Analysis”, Prentice Hall of India Ltd.
2. Ghosh, “Network Theory: Analysis and Synthesis”, PHI Learning Pvt. Ltd

BEC3451 ADVANCE ANALOG CIRCUITS LAB

Note: Minimum of 8 experiments are to be performed from the following list:

1. Transistorized oscillators: Phase shift, Weinbridge, Hartley's & Collpit's.
2. IC 555 Timer: Monostable & Astable operation circuit.
3. IC 565: PLL Applications.
4. IC 566: VCO Applications.
5. Study of A/D, D/A Converters.
6. To study of Op-amp as Adder, integrator & voltage comparator.
7. Study of Op-amp as Astable & Monostable multivibrators.
8. Sampling & reconstruction using Nyquist criteria.
9. Function generator using operational amplifier (single, triangular & sq. wave)
10. FET Amplifiers.
    (a) Single Stage Common source FET amplifier plot of gain (in db) vs frequency.
    (b) Measurement of BW, input impedance, maximum signal handling capacity of an amplifier.
11. Voltage to current & current to voltage converter.
12. Filter design using Op-amp.

BEC3452 COMPUTER ORGANIZATION LAB

List of Experiments:

1. Bread Board Implementation of Flip-Flops.
2. Experiments with clocked Flip-Flop.
3. Design of Counters.
4. Bread Board implementation of counters & shift registers.
5. Implementation of Arithmetic algorithms.
6. Bread Board implementation of Adder and Subtractor (Half, Full) .
7. Bread Board implementation of Binary Adder.
8. Bread Board implementation of Seven Segment Display.

BEC3453 ELECTRONICS WORKSHOP & PCB LAB

1. Study of CRO, DMM & Function Generator.
2. Identification of Active & Passive Components.
3. Winding shop: Step down transformer winding of less than 5VA.
4. Soldering shop: Fabrication of DC regulated power supply
5. PCB Lab: (a) Artwork & printing of a simple PCB.
   (b) Etching & drilling of PCB.
6. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
7. Testing of regulated power supply fabricated.

BEC3455 NETWORK LAB

Note: Minimum eight experiments are to be performed from the following list.

1. Verification of principle of superposition with dc and ac sources.

2. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits.

3. Verification of Tellegens theorem for two networks of the same topology.

4. Determination of transient response of current in RL and RC circuits with step voltage input.

5. Determination of transient response of current in RLC circuit with step voltage input for under damp, critically damp and over damp cases.

6. Determination of frequency response of current in RLC circuit with sinusoidal ac input.

7. Determination of z and h parameters (dc only) for a network and computation of Y and ABCD parameters.

8. Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values.

9. Determination of image impedance and characteristic impedance of T and Π networks, using O.C. and S.C. tests. Write Demo for the following in Ms-Power point.

10. Verification of parameter properties in inter-connected two port networks: Series, parallel and cascade also study loading effect in cascade.

11. Determination of frequency response of a Twin-T notch filter.

12. To determine attenuation characteristics of a low pass / high pass active filters.

BEC3501 ANALOG COMMUNICATION SYSTEM

Course Objective:

1. The main objective of this course is to provide the fundamental knowledge of basic communication system.
2. To make our students aware about various modulation and demodulation techniques used in analog communication, noise handling and multiplexing along with the working principles of transmitters and receivers used in analog communication systems.

Learning Outcome:

The student will learn:

1. Basic concepts of any generalized communication system.
2. Amplitude, frequency and phase modulation techniques.
3. Different types of sampling and PCM system.
4. How to analyze the system performance in the presence of noise .

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Communication system and Amplitude Modulation** Overview of Communication system, Communication channels, Need for modulation, Baseband and Passband signals, Amplitude Modulation: Concept of Amplitude Modulation, Switching Modulator, Envelope Detector, DSB-SC Modulation, Ring Modulator, Coherent Detection, SSB Modulation, VSB Modulation.	30 Hours	1
II	**Frequency-Modulation Systems** Angle Modulation: Phase and Frequency Modulation, Relationship Between Phase and Frequency Modulation, Phase and Frequency Deviation, Narrowband &Wideband FM, FM Generation: Parameter-Variation Method, Armstrong Method. FM Demodulators, The super heterodyne receiver.	30 Hours	1

III	**Analog to Digital Conversion** The Sampling Theorem, PAM, PPM, PWM, Natural Sampling, Flat-Top Sampling, Signal Recovery through Holding, Quantization of Signals, Quantization Error, Pulse Code Modulation (PCM), Electrical Representation of Binary Digits, The PCM System, Companding, Multiplexing PCM Signals, Differential PCM, Delta Modulation, Adaptive Delta Modulation	30 Hours	1
IV	**Noise** Noise: Shot noise, thermal noise and white noise, Noise equivalent bandwidth, Narrow band noise. Noise in analog modulation: Receiver model, Noise in DSB SC receiver, Noise in AM Receiver, Noise in FM Receiver, Capture effect, Pre emphasis and De-emphasis.	30 Hours	1

Text Book:

1. Simon Haykin," Communication Systems" John Wiley & Sons 5thEdition.
2. Principles of Communication Systems, Taub& Schilling, TMH**.**

References Books:

1. Modern Digital and Analog Communication Systems, B.P. Lathi, OUP
2. Digital Communications: Fundamental And Applications, Sklar, Pearson
3. Digital Communications, Prokias, MGH
4. Communication Systems: Analog and Digital, R Singh,S. Sapre, McGraw Hill.

BEC3502 / BEC3404 MICROPROCESSOR

Course Objective:

1. To learn the generations of microprocessor.
2. To learn the basics, architecture and programming of 8085.
3. To learn the interfacing of microprocessor with various ICs.
4. To learn the basics of 8086 microprocessor.

Learning Outcome:

1. Students will understand basics of computer system and microprocessors.
2. Students will understand practical application and interfacing of microprocessor chips.
3. Deep knowledge about programming in Assembly Language.
4. Students will be able to understand the concepts of higher generation microprocessors.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Microprocessor Architecture and microcomputer system** Microprocessor Architecture and Its Operations, Memory, Input and Output (I/O) Devices, Example of microcomputer system, The 8085 MPU, Memory interfacing, interfacing output display, interfacing input device, Memory mapped I/O.	30 Hours	1
II	**Programming 8085** 8085 programming model, Instruction classification: Data transfer operation, Arithmetic operation, Logic operations and Branch operations. Writing assembly language programs, Debugging a program. Programming techniques: Looping, Counting and Indexing. Time delay programs, Stack, subroutine, Conditional call, Return instruction. Code conversion: BCD to Binary conversion, Binary to BCD and BCD to seven segment LED code conversion.	30 Hours	1

III	**Interfacing Devices** Digital to analog converter, Analog to digital converter, 8279 programmable Keyboard/display interface, 8255 Programmable peripheral interface: Interfacing Keyboard and Seven segment display, 8254 Programmable interval timer, 8259 Programmable interrupt controller, 8237 DMA controller.	30 Hours	1
IV	**8086 microprocessor** 8086 microprocessor: Register organization, Architecture, Signal Description, Physical memory organization, General bus operation, I/O addressing capability, Minimum mode 8086 system and timings, Machine language instruction format, Addressing modes, Assembler directives and Operators.	30 Hours	1

Text Books

1. Microprocessor Architecture and Programming & Application with 8085,Ramesh S Goanker, Wiley Eastern Ltd Fifth edition\
2. Advanced Microprocessor and peripherals, Ray A K,B.M Burchandi,2nd Edition,TMH

Reference Books:

1. Advanced Microprocessors and Interfacing, B. Ram, TMH.
2. Microprocessors and Interfacing by Douglas V. Hall, McGraw Hill International Ed. 1992

BEC3503 ANTENNA AND WAVE PROPAGATION

Course Objective:

1. To study antenna fundamentals, concept of radiation and analyze radiation characteristics.
2. To study types of antennas like loop antenna, helical antenna, biconical antenna, slot antenna and lens antenna.
3. To study radiation wave propagation.

Learning Outcome:

1. Students to have knowledge of antenna fundamentals and its parameters.
2. To study characteristics and types of antennas.
3. Understand wave propagation mechanisms.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Antenna Fundamentals** Basic Concepts: Antenna parameters, Patterns, Beam area, Radiation intensity, Beam efficiency, Directivity and gain. Antenna concepts: Effective aperture, Scattering aperture, Loss aperture, Collative aperture, Physical aperture, Aperture efficiency and Effective height. Short dipole, Friis transmission equation, Duality of antenna, point sources, Antenna Arrays: Linear arrays, Broadside arrays and End fire arrays. Huygens principle, Antenna measurements: Pattern measurement, Phase measurement, Gain and Impedance.	30 hours	1
II	**Types of Antennas** Loop antenna: Small loop and Circular loop. Radiation resistance, Directivity, Square loops, Helical antenna: Helical geometrics, Monofliar helices, Pattern, beam width, gain and impedance, Polyrod-helix, Corner-helix, Two wire line-helix and Helix-lens. Biconical antenna Characteristics: impedance and pattern. Conical and triangular antenna, Brown Woodward (bow tie) antenna, Slot, horn, complementary and Lens antenna.	30 Hours	1
III	**Wave propagation** Basic types of propagation: Ground wave, Space wave	30 Hours	1

	and Sky wave propagation. Sky wave propagation: Structure of ionosphere, Mechanism of refraction, Critical frequency, Skip distance, Effect of earth's magnetic field, Energy loss in ionosphere due to collision, Maximum usable frequency, Fading and diversity. Space wave propagation: Reflection from ground for vertically and horizontally polarized waves, Reflection characteristics of earth, Resultant of direct and reflected ray at receiver and Duct propagation. Ground wave propagation: Attenuation characteristics of ground wave propagation and Calculation of field strength at a distance.		

Text Books:

1. John D. Kraus, Ronald J. Mashefka, " Antenna for All Applications", Tata McGraw-Hill, Second Edition, Reprint 2007.
2. K.D. Prasad, "Antennas and Wave Propagation", Satya Prakashan, Third Edition, Reprint 2005.

Reference Books:

1. C A. Balanis , "Antenna Theory ", John Wiley ,Second Edition,2009.
2. Jordan and Balman, "Electromagnetic Waves and Radiating Systems", PHI.
3. G. Kennedy and B. Davis, "Electronic Communication Systems", Tata McGraw Hill Publishing Company Ltd., Fourth Edition.

BEC3505 CONTROL SYSTEMS

Course Objective:

1. To develop a strong foundation in the field of control system.
2. The subject gives the knowledge about different plots.
3. Function (s) to control a machine.

Learning Outcome:

At the end of the course, student should be able:

1. Characterize a system and find its steady state behavior.
2. Investigate stability of a system using different tests
3. Design various controllers.
4. Solve liner, non-liner and optimal control problems

Course Contents:

Module	Course Topics	Total Hours	Credits
I	The Control System: Open loop & closed control, servomechanisms, physical examples, Transfer functions, Block diagram algebra, Signal flow graph, Mason's gain formula, Reduction of parameter variation and effects of disturbance by using negative feedback Control System	30 Hours	1
II	Time Response analysis: Standard test signals, Time response, First and second order systems, Time response specifications, steady state errors and error constants Design specifications of second order systems: Derivative error, Derivative output, Integral error and PID compensations, Design considerations for higher order systems, Performance indices Stability and Algebraic Criteria: Concept of stability and necessary conditions, Routh-Hurwitz criteria and limitations Root Locus Technique: The root locus concepts, Construction of root loci	30 Hours	1
III	Frequency response Analysis: Frequency response, Correlation between time and frequency responses, Polar and inverse polar plots, Bode plots Stability in Frequency Domain: Nyquist stability criterion, Assessment of relative stability, Gain margin and Phase margin, Introduction to Design: The design problem and preliminary	30 Hours	1

	considerations lead, lag and lead-lag networks, Design of closed loop systems using compensation techniques in time domain and frequency domain		
IV	State – Variable Analysis :Introduction State Space representation of linear systems, Transfer Function and state Variables, State Transition Matrix, Solution of state equations for homogeneous and non-homogeneous systems, Applications of State-Variable technique to the analysis of linear systems, Conversion of state variable model to transfer function model and vice-versa, Diagonalization, Controllability and observability and their testing.	30 Hours	1

Text/Reference books:

1. Control System Engineering‟ by Nagrath & Gopal, New age International.
2. Modern Control Engineering ‟by K. Ogata, Prentice Hall of India.
3. Automatic Control System‟ by B.C. Kuo & Farid Golnaraghi, Wiley India Ltd.
4. Linear Control System with MATLAB Application‟ byB.S Manke, Khanna Publication.

BEC3506 ELECTROMAGNETIC FIELD THEORY

Course Objective:

1. To learn the Coordinate systems and their transformation.
2. Calculate electric field, force, potential, energy from various charges and charge distributions.
3. Obtain an understanding of Maxwell's equations and be able to apply them to solving practical electromagnetic fields problems.
4. Fundamental concepts covered will include: plane wave propagation in different media, power flow, polarization, transmission and reflection at an interface, transmission lines.

Learning Outcome:

At the end of this course students will demonstrate the ability to

1. To improve their ability in solving geometrical applications problems.
2. To equip themselves familiar with the functions of several variables in the field of EMT.
3. To familiarize with the applications of Electromagnetic Waves & Transmission line and to expose to the concept of three dimensional analytical geometry.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Coordinate systems and transformation:** **Basics of Vectors:** Addition, subtraction and multiplications; Cartesian, Cylindrical, Spherical coordinates and transformation. **Vector calculus:** Line surface and volume integrals, Del operator, Gradient of a scalar, Divergence of a vector, Curl of a vector, Divergence theorem, Stokes's theorem and Laplacian of a scalar.	30 Hours	1
II	**Electrostatics:** Electrostatic fields, Coulombs law and field intensity, Electric field due to continuous charge distributions. Electric flux density, Gauss's Law – Maxwell's equation, Application of Gauss's Law, Electric Potential-Maxwell's equation Electric dipole and flux lines, energy density in electrostatic fields. Convection and conduction currents, conductors,	30 Hours	1

	polarization in dielectrics, dielectric constants, continuity equation. Electrostatic boundary condition, Poisson's and Laplace's equations.		
III	**Magneto-statics**: Magneto-static fields, Biot-Savart's Law, Ampere's circuit law. Maxwell's equation, application of ampere's law, magnetic flux density- Maxwell's equation, Maxwell's equation for static fields, Magnetic scalar and vector potential, Forces due to magnetic field, magnetic torque and moment, a magnetic dipole, magnetization in materials. Magnetic boundary conditions. Inductors and inductances, magnetic energy.	30 Hours	1
IV	**Electromagnetic Wave**s: Maxwell's equation in Time varying Field. Faraday's Law. Displacement current, Electromagnetic wave propagation, Wave propagation in lossy dielectrics, Plane waves in lossless dielectrics, Plane wave in free space, Plain waves in good conductors, Power and the pointing vector, reflection of a plain wave in a normal incidence and oblique incidence. **Transmission line:** Transmission line parameters, Transmission line equations, input impedance, characteristic impedance. Lossless Transmission line open circuit and short circuit Transmission line Reflection in Transmission Line and standing wave ratio and power.	30 Hours	1

Text Book:

1. MNO Sadiku, "Elements of Electromagnetic', Oxford University Press.

Reference Book:

1. WH Hayt and JA Buck, "Engineering Electromagnetic", McGraw- Hill Education.

BEC3551 COMMUNICATION LAB -1

List of Experiments:

1. To study DSB/ SSB amplitude modulation & determine its modulation factor &power in side bands.

2. To study amplitude demodulation by linear diode detector

3. To study frequency modulation and determine its modulation factor

4. To study PLL 565 as frequency demodulator.

5. To study sampling and reconstruction of Pulse Amplitude modulation system.

6. To study the Sensitivity, Selectivity, and Fidelity characteristics of super heterodyne receiver.

7. To study Pulse Amplitude Modulation

    a) using switching method
    b) by sample and hold circuit

8. To demodulate the obtained PAM signal by 2nd order LPF.

9. To study Pulse Width Modulation and Pulse Position Modulation.

10. To plot the radiation pattern of a Dipole, Yagi-uda and calculate its beam width.

11. To plot the radiation pattern of Horn, Parabolic & helical antenna. Also calculate beam width & element current.

12. Design and implement an FM radio receiver in 88-108 MHz.

BEC3552 / BEC3454 MICROPROCESSORS LAB

List of Experiments:

1. Addition of 8 bit numbers series.
2. Addition of two 16 bit numbers.
3. Subtraction of two 8 bit numbers.
4. Multiplication and division of two 8 bit numbers.
5. To find the maximum number in a given string.
6. Binary to gray code conversion.
7. To sort a string of a one byte numbers in ascending order.
8. To sort a string of a one byte numbers in descending order.
9. Interfacing with ADC/DAC.
10. Interfacing with 8253.
11. Interfacing with 8255 in I/O mode.
12. Verification of interrupts.

BEE2552CONTROL SYSTEM LAB

Note: The minimum of ten experiments are to be performed from the following, out of which at-least three should be software based.

1. To determine response of first order and second order systems for step input for various values of constant "K" using linear simulator unit and compare theoretical and practical results.

2. To study P, PI and PID temperature controller for an oven and compare their performance.

3. To study and calibrate temperature using resistance temperature detector (RTD)

4. To design Lag, Lead and Lag-Lead compensators using Bode plot.

5. To study DC position control system

6. To study synchro-transmitter and receiver and obtain output V/S input characteristics.

7. To determine speed-torque characteristics of an ac servomotor.

8. To study performance of servo voltage stabilizer at various loads using load bank.

9. To study behavior of separately excited dc motor in open loop and closed loop conditions at various loads.

10. To study PID Controller for simulation proves like transportation lag.

Software based experiments (Use MATLAB, LABVIEW software etc.)

11. To determine time domain response of a second order system for step input and obtains performance parameters.

12. To convert transfer function of a system into state space form and vice-versa.

13. To plot root locus diagram of an open loop transfer function and determine range of gain, 'k' for stability.

14. To plot a Bode diagram of an open loop transfer function.

15. To draw a Nyquist plot of an open loop transfer functions and examines the stability of the closed loop system.

BEC3601 DIGITAL SIGNAL PROCESSING

Course Objective:

1. To study discrete time system analysis and Z-transform.
2. To study efficient computation of DFT.
3. To study realization and design of filters.
4. To learn the concepts of windows (Hamming, Hanning, Blackmann and Kaiser).

Learning Outcome:

1. Students will understand z- transform analysis.
2. Learn to realize filter structures.
3. Design IIR and FIR filters.
4. Students will be able to learn the concepts of Window design.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Discrete time system analysis and Z Transform** Discrete Fourier transform: The Discrete Fourier transform, The DFT as linear transform. Properties of DFT: Periodicity, linearity and symmetry property, additional properties of DFT, Multiplication of two DFT and circular convolution. Relationship of the DFT to Other transforms. Z transform: Properties of Z-transform, Inverse Z-transform.	30 Hours	1
II	**Efficient Computation of DFT** Efficient computation of the DFT: FFT algorithms, Direct computation of the DFT, Radix-2 FFT algorithms, Efficient computation of the DFT of two real sequences, Efficient computation of the DFT of a 2N point real sequences, Gortezel algorithm, Chirp Z-transform algorithm.	30 Hours	1
III	**Realization of Filter Structures** IIR Filter Structure: Direct forms structure, Cascade form structure, Parallel form structure and signal flow graph. FIR Filter Structures: Direct form structure, frequency	30 Hours	1

	sampling structure, lattice structure and Cascade form structure.		
IV	**Design of filters** Design of IIR Filters from Analog Filters: IIR filter design by approximation of derivatives, IIR filter design by impulse invariance, IIR filter design by the Bilinear transformation, Matched-z transformation, Butterworth filter, Chebyshev filter: Characteristics of commonly used analog filters.Design of FIR Filter :Symmetric and anti-symmetric FIR Filters, Design of linear-phase FIR Filters using windows, Design of linear-phase FIR filters by the frequency sampling method, Design of equiripple linear phase FIR filters and Hilbert transformers.	30 Hours	1

Text Books:

1. J.G. Proakis& D.G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI/Pearson.
2. S. Salivahanan et al, Digital Signal Processing, TMH.

Reference Books:

1. L.R. Rabiner & B. Gold, Theory and Application of Digital Signal Processing., PHI
2. Meyer-Basse U, Digital Signal Processing with FPGA, Springer India
3. Babu R, Digital Signal Processing , Scitech
4. S.K. Mitra, Digital Signal Processing - A Computer based approach, TMH
5. Pradhan, Digital Signal Processing Applications, Jaico

BEC3602 MICROWAVE ENGINEERING

Course Objective:

1. To understand principles of microwave devices.
2. To learn various types of microwave tubes like klystron, magnetron, etc.
3. To learn measurement of microwave components and parameters.

Learning Outcome:

1. Learn design criteria for waveguide and coaxial microwave components.
2. Learn different types of microwave tubes like klystron, magnetron, travelling wave tube, etc.
3. Work in small teams and design, fabricate and test useful microwave components.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Microwave waveguides and components** Rectangular waveguides: Solutions of wave equations in rectangular coordinates, TE mode, TM mode, TEM mode1, Power transmission, Power losses and Excitation of modes. Circular waveguides: Solutions of wave equations in cylindrical coordinates, TE mode, TM mode, TEM mode, Power transmission, Power losses and Excitation of modes. Microwave cavities: Rectangular cavity resonator, Circular cavity resonator and Q factor of cavity resonator. Microwave hybrid circuits: Waveguide tees, Magic tees, Rat race circuits, Waveguide corners, bends and twists. Directional couplers: Two hole directional coupler, S matrix of directional coupler and Hybrid couplers, Circulators and isolators, Strip lines, Microstrip lines, Parallel strip lines, Coplanar strip lines and Shielded strip lines.	30 Hours	1
II	**Microwave Tubes** Klystrons: Re-entrant cavities, Velocity modulation process, Bunching process, Output power and beam loading. Multicavity klystron amplifiers: Beam current density, Output current and output power of two-cavity klystron and Output power of four-cavity klystron. Reflex klystrons: Velocity modulation, Power output,	30 Hours	1

	efficiency and electronic admittance. Travelling wave tubes: Slow wave structures, Amplification process, Convection current, Axial electric field, wave modes and gain consideration. Magnetrons: Cylindrical magnetron, Linear magnetron, Coaxial magnetron, Voltage tunable magnetron, Inverted coaxial magnetron and Frequency agile coaxial magnetron. Backward wave oscillator.		
III	**Microwave Measurements** General set up of microwave test bench, Slotted line carriage, VSWR meter, Microwave power measurement techniques, Crystal detector, Frequency measurement, Wavelength measurement, Impedance and reflection coefficient, Insertion and attenuation loss measurements, Measurement of antenna characteristics, Microwave link design.	30 Hours	1

Text Books:

1. Samuel Y. Liao, "*Microwave Devices and Circuits*", 3rd Ed, Pearson Education.
2. A. Das and S. K. Das, "*Microwave Engineering*", TMH.

Reference Books:

1. R.E Collin, "Foundation for Microwave Engineering ", 2nd Ed., John Wiley India.
2. David M. Pozar, "Microwave Engineering", 4^{th} Ed, John Wiley & Sons Inc.
3. G. Kennedy and B. Davis, "Electronic Communication Systems", Tata McGraw Hill Publishing Company Ltd., Fourth Edition.

BEC3603 DIGITAL COMMUNICATION SYSTEM

Course Objective:

1. To provide the fundamental knowledge of digital communication systems.
2. Design optimum receivers for digital communication system.
3. To analyse the error performance of digital communication system.
4. To impart knowledge about designing digital communication systems under given error performance constrains.

Learning Outcome:

The student will

1. Learn to identify the functions of different components of a digital communication system.
2. Learn about random variables and random process.
3. Understand about information theory and spread spectrum techniques.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Principles of Digital Data Transmission** Digital communication system, Line Coding, Pulse shaping, Scrambling, Digital receivers and Regenerative Repeaters, Eye diagram, PAM:M-ary Baseband Signalling for Higher Data Rate, Digital Carrier Systems, M-ary Digital Carrier Modulation.	30 Hours	1
II	**Fundamentals of Probability theory and Random Processes** Concept of Probability, Random variables, Statistical averages (Means), Correlation, Sum of Random Variables, Central Limit Theorem, From Random Variable to Random Process, Classification of Random Processes, Power spectral density, Multiple Random Processes.	30 Hours	1
III	**Performance Analysis of Digital communication**	30 Hours	1

	systems Optimum linear Detector for Binary polar signaling, General Binary Signaling, Coherent Receivers for Digital Carrier Modulations, Signal Space Analysis of Optimum Detection, Vector Decomposition of White Noise Random processes, General Expression for Error Probability of optimum receivers.		
IV	**Information Theory and Spread spectrum modulation** Unit of Information, Entropy, Rate of Information, Joint Entropy & Conditional Entropy, Mutual Information, Channel Capacity, Shannon's Theorem, Coding Efficiency, Shannon-Fano Coding, Error Control Coding, Block Code, Cyclic Code, Convolution Code, Pseudo-Noise Sequences, Direct Sequence Spread Spectrum (DS/SS), Frequency Hopping Spread Spectrum(FH/SS) systems, Applications of Spread Spectrum.	30 Hours	1

Text Books:

1. B.P Lathi, "Modern Digital & Analog Communication Systems", Oxford University Press, Fourth Edition, 2010.
2. R.P. Singh& S.D. Sapre, "Communication Systems Analog and Digital" Tata McGraw Hill.

References Books

1. Simon Haykin , "Digital Communication" , John Wiley , Fourth Edition, Reprint 2009.
2. Taub & Schilling, "Principles of Communication Systems", TMH.
3. Sklar, "Digital Communications: Fundamental And Applications", Pearson.
4. Prokias , "Digital Communications ",TMH .

BEC3604 VLSI TECHNOLOGY

Course Objective:

1. To develop background of VLSI fabrication technology.
2. To study complete process of crystal wafer preparation.
3. To understand the issues related to metallization and IC Fabrication.

Learning Outcome:

Student will get knowledge about

1. Different methods of crystal wafer preparation.
2. Various techniques involved in IC fabrication.
3. Need of metallization and precautionary actions taken during IC fabrication.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**IC TECHNOLOGY,EPITAXY, OXIDATION** Introduction to IC Technology, Crystal Growth Wafer Preparation, Electronic Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Processing Considerations. Epitaxy: Vapor–Phase Epitaxy, Molecular Beam Epitaxy, Silicon on Insulators. Oxidation: Utility of Thermal Oxidation, Growth and Properties of Oxide Layers on Silicon, Growth Rate of Silicon Oxide Layer, Effect of impurities on the Oxidation Rate.	30 Hours	1
II	**LITHOGRAPHY,DIFFUSION** Lithography: Optical Lithography, Photoresist, Photo masks, Wet and Dry Etching, Reactive Plasma Etching. Diffusion: Diffusion of Impurities in Silicon , Diffusion Equations, Diffusion Profiles, Diffusion Furnace, Diffusion using Solid, Liquid and Gaseous Sources, Sheet Resistance and its measurement. Ion-Implantation: Ion-Implantation Technique, Advantages of Ion-Implantation.	30 Hours	1

III	**METALLIZATION , FABRICATION PROCESSES** Metallization: Metallization Application, Metallization Choices, Physical Vapor Deposition, Chemical Vapor Deposition, Vacuum Deposition, Sputtering Apparatus. IC Fabrication: Bipolar IC Fabrication Process, NMOS IC Fabrication Process, CMOS IC Fabrication Process.	30 Hours	1

Text book:

1. S. M. Sze , "VLSI Technology", Tata McGraw –Hill, Second Edition,1988.
2. K.R.Botkar, "Integrated Circuits" Khanna Publishers, Ninth Edition,1996.

References:

1. 1. Douglas A. Pucknell , Kamran Eshraghian, " Basic VLSI Design", Prentice-Hall of India, Third Edition.
2. John P. Uyemura , "CMOS Logic Circuit Design", Kluwer Academic Publishers New
3. York, Boston, Dordrecht, London, Moscow, Reprint 2002.
4. Plummer , "Silicon VLSI Technology", Pearson Education, First Edition,2001.

Generic Elective –I

GE33411 MICROCONTROLLER

Course Objective:

1. To provide basic knowledge of microcontrollers.
2. Understanding the concepts of assembly language programming of microcontroller.
3. Understanding the basics of interfacing of microcontrollers.

Learning Outcome:

Student will be able

1. To interface microcontroller with the devices.
2. To understand different parameters of microcontroller IC 8051.
3. To program microcontroller IC 8051.
4. To interface microcontroller IC 8051 with other devices.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Overview of the 8051 family, Inside the 8051, 8051 data types and directives, 8051 flag bits and PSW register, 8051 Register bank and stack, Addressing modes: Immediate and Register addressing modes, Accessing Memory using various Addressing Modes, Bit Address for I/O and RAM, Extra 128 byte on chip Ram on 8052	30 Hours	1
II	**Microcontrollers – 8051** 8051 interrupts, Loop and jump instructions, Call instructions, Time delay for various 8051 chips. I/O port programming: 8051 I/O programming, I/O bit manipulation programming, Arithmetic and logic instructions: Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD , ASCII and other application programs.	30 Hours	1

III	**8051 programming in C** Data types and time delay in 8051 C, 3.2 I/O programming in 8051 C, logic operations in 8051 C, Data conversion programs in 8051 C, Data serialization in 8051 C. Timer programming: Programming 8051 timers, Counter programming. Serial port programming: Basics of serial communication, 8051 connection to RS-232, 8051 serial port programming, Programming the second serial port.	30 Hours	1
IV	**Interfacing 8051** LCD interfacing, Keyboard interfacing, Parallel and serial ADC, DAC interfacing, Interfacing to external memory, 8255 interfacing, Relays and opto-isolators, Stepper motor interfacing, DC motor interfacing and PWM.	30 Hours	1

Text Books:

1. The 8051 Microcontroller and embedded systems-Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rollin D McKinley , Pearson , Second Edition
2. Microcontroller Theory and Applications, Ajay V Deshmukh,TMH@2005

Reference Books:

1. Ayala Kenneth, “The 8051 Microcontroller”, Cengage Learning, 3rd Edition.
2. Shah Satish, “ 8051 Microcontrollers MCS 51 Family and its variants”, Oxford Publications.

GE33412 ADVANCE SEMICONDUCTOR DEVICES

Course Objective:

1. Understand the basic properties of semiconductor materials and devices.
2. Understanding of existing devices, their principles and applications.
3. Understanding the fundamentals of transistors like MESFET, MOSFET.
4. Understanding of various optoelectronic and microwave devices.

Learning Outcome:

Students will be able tounderstand

1. The current voltage characteristics of semiconductor devices.
2. The junction properties and breakdown mechanism.
3. The principle of diode and their application in today's world.
4. The transit time diodes and their working principle.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Review of Fundamentals of Semiconductors:** Semiconductor Materials and their properties, Carrier Concentration in Semiconductors: Fermi Level, Electron And Holes Concentration at Equilibrium, Temperature dependence of carrier concentration, Excess Carriers in Semiconductor, Optical Absorption, Absorption coefficient, Luminescence, Direct and Indirect Recombination, Carrier Lifetime and Photoconductivity, Photoconductor, Drift of carriers in an electric field, Effect of temperature and doping on mobility, Hall effect, Diffusion of carriers, Einstein Relation, The Continuity Equation, Diffusion length, The Haynes-Shockley Experiment.	30 Hours	1
II	**Junctions and Interfaces:** Description of p-n junction: The Contact Potential, Space charge at junction, Steady State condition in forward and reverse bias junction, Transient and AC conditions, Capacitance of PN junctions: Varacter Diode,	30 Hours	1

	Description of Breakdown Mechanism, Zener Breakdown, Avalanche Breakdown.		
III	**Special Diodes** Majority Carrier Diodes: The Tunnel Diode, The Schottky Barrier Diode, Semiconductor controlled rectifier (SCR), Microwave Diodes, The p-i-n Diode, The IMPATT Diode, TRAPATT Diode, Transferred Electron Devices (Gunn diode)Optoelectronic Devices: The Solar Cell, Photo detectors, Light Emitting Diodes, Semiconductor Lasers.	30 Hours	1
IV	**FET Transistors** Metal Semiconductor Field Effect Transistors: Basic Types of MESFET, Models for I-V Characteristics of Short Channel MESFETs, High Frequency Performance, MESFET Structures, MOS Transistors: Basic Structures and the Operating Principle, I-V Characteristics, Short-Channel Effects, MOSFET Structures, Charge Coupled Device.	30 Hours	1

Text Books:

1. M.S. Tyagi, "Introduction to Semiconductor Materials and Devices", John Willy-India Pvt. Ltd.
2. B. G. Streetman and S. Banerjee, "Solid state electronics devices", 5th Edition, PHI.

Reference Books:

1. S. M. Sze, "Physics of Semiconductor Devices", 2nd Edition, John Willy-India Pvt. Ltd.
2. Millman&Halkias, "Electronic Devices And circuits", TMH
3. Donald A. Neamen, "Semiconductor Physics And Devices", TMH

GE33413 SENSORS AND TRANSDUCERS

Course Objective:

1. To understand about various sensors used in real world applications
2. Gain knowledge about structure and properties of various sensors and transducers.
3. Gain concepts about various classification methods and performance measures of sensors.

Learning Outcome:

1. Students will understand various properties of sensors and materials.
2. Students will know about mechanical and electro-mechanical types of sensors.
3. Students will understand about various applications of sensors in human life.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**INTRODUCTION** Definition, classification, static and dynamic parameters, Characterization-Electrical, mechanical, thermal, optical, biological and chemical, Classification of errors-Error analysis, Static and dynamic characteristics of transducers, Performance measures of sensors. **MECHANICAL AND ELECTROMECHANICAL SENSORS** Resistive Potentiometer, strain gauge, Inductive sensors and transducer, capacitive sensors, ultrasonic sensors.	30 Hours	1
II	**THERMAL AND RADIATION SENSOR** **Thermal Sensors:** Gas thermometric sensors, acoustic temperature sensors, magnetic thermometer, resistance change-type thermometric sensors, thermo emf sensors, junction semiconductor types, Thermal radiation sensors, spectroscopic thermometry **Radiation Sensors:** Photo detectors, photovoltaic and photo junction cells, photo sensitive cell, photo FETs and other devices.	30 Hours	1

III	**MAGNETIC AND ELECTROANALYTICAL SENSOR** **Magnetic Sensors:** Force and displacement measurement, magneto resistive sensors, Hall Effect sensor, Inductance and eddy current sensors, Angular/rotary movement transducer, Electromagnetic flow meter, squid sensor. **Electro analytical Sensors:** Electro chemical cell, cell potential, sensor electrodes, electro ceramics in gas media, chemFET.	30 Hours	1
IV	**SENSORS AND THEIR APPLICATIONS** Automobile sensor, Home appliance sensor, Aerospace sensors, sensors for manufacturing, medical diagnostic sensors, environmental monitoring.	30 Hours	1

Text Books:

1. Patranabis D, “Sensor and Actuators”, Prentice Hall of India (Pvt) Ltd., 2006.
2. Sawhney A.K, Puneethsawhney, “A Course in Electrical and Electronic Measurements and Instrumentation”, DhanpatRai Publications, 2012.

Reference Books:

1. Ian Sinclair, “Sensor and Transducers”, Elsevier India Pvt Ltd, 3rd Edtion, 2011.
2. Ernest O. Doeblin, “Measurement System, Application and Design”, Tata McGraw Hill Publishing Company Ltd., 5th Edition, 2008.

GE33414 DATA STRUCTURE

Course Objective:

1. Familiarize the student with good programming design methods, particularly Top Down design.
2. To impart knowledge about developing algorithms via manipulating stacks, queues, linked lists, trees, and graphs.
3. To impart knowledge about developing recursive algorithms as they apply to trees and graphs.

Learning Outcome:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyse the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction** Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	30 Hours	1
II	**Stacks and Queues** ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue;	30 Hours	1

	Operations on each types of Queues: Algorithms and their analysis.		
III	**Linked Lists** Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis. **Trees:** Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.	30 Hours	1
IV	**Sorting and Hashing** Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. **Graph:** Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	30 Hours	1

Text book:

1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publications Pvt Ltd Delhi India.
2. Aaron M. Tenenbaum, Yedidyah Langsam and Moshe J. Augenstein "Data Structures Using C and C++", PHI Learning Private Limited, Delhi India

References:

1. A.K. Sharma ,Data Structure Using C, Pearson Education India.
2. Rajesh K. Shukla, "Data Structure Using C and C++" Wiley Dreamtech Publication.

BEC3651 DIGITAL SIGNAL PROCESSING LAB

LIST OF EXPERIMENTS:

1. With the help of Fourier series, make a square wave from sine wave and cosine waves. Find out coefficient values.
2. Evaluate 4 point DFT of and IDFT of $x(n) = 1, 0 \leq n \leq 3$; 0 elsewhere.
3. Implement the FIR Filters for 2 KHz cutoff frequency and 2 KHz bandwidth for band pass filter.
4. Design FIR filter using Fourier series expansion method.
5. Implement IIR low pass filter for a 4 KHz cutoff frequency and compare it the FIR filter with the same type use chirp as input signal.
6. Verify Blackman and Hamming windowing techniques for square wave as an input which window will give good results.
7. Implement the filter functions.
8. Generate DTMF sequence 1234567890*# and observe its spectrogram.
9. Generate an Amplitude Modulation having side low frequencies 1200 Hz and 800 Hz. Observe and verify the theoretical FFT characteristics with the observed ones.
10. Generate Frequency Modulation having carrier frequencies 1 KHz and modulating frequency 200 Hz with the modulation index of 0.7. Observe and verify the theoretical FFT characteristics with the observed ones.
11. Generate an FSK wave form for transmitting the digital data of the given bit sequence. Predict and verify the FFT for the same one.
12. To study the circular convolution.

BEC3652 MICROWAVE LAB

List of Experiments:

1. Study of Reflex Klystron Characteristics.
2. Measurement of guide wavelength and frequency of the signal in a rectangular Waveguide using slotted line carriage in a Microwave Bench.
3. Measurement of impedance of an unknown load connected at the output end of the slotted line carriage in a Microwave Bench.
4. Determine the S-parameter of any three port Tee.
5. Determine the S-parameter of a Magic Tee.
6. Study various parameters of Isolator.
7. Measurement of attenuation of an attenuator and isolation, insertion loss, cross coupling of a circulator.
8. Determine coupling coefficient, insertion loss, directivity and isolation coefficient of anti Multi-Hole directional coupler.
9. To study working of MIC components like Microstrip Line, filter, directional Coupler, Wilkinson Power Divider, Ring resonator & coupler, antennas & amplifies.
10. Study of waveguide horn and its radiation pattern and determination of the beam width.

BEC3653 COMMUNICATION LAB - II

List of Experiments:

1. To construct a triangular wave with the help of Fundamental Frequency and its Harmonic component.
2. To construct a Square wave with the help of Fundamental Frequency and its Harmonic component.
3. Study Frequency Division Multiplexing (FDM) & De-multiplexing.
4. Study of Time Division Multiplexing (TDM) &De-multiplexing.
5. Study of Pulse code modulation (PCM) and its demodulation using Bread Board.
6. Study of delta modulation and demodulation and observe effect of slope overload.
7. Study of pulse data coding techniques for NRZ formats.
8. Study of Data decoding techniques for NRZ formats.
9. Study of Manchester coding and decoding.
10. Study of Amplitude shift keying modulator and demodulator.
11. Study of Frequency shift keying modulator and demodulator.
12. Study of Phase shift keying modulator and demodulator
13. Study of single bit error detection and correction using Hamming code.
14. Measuring the input impedance and Attenuation of a given transmission line.

BEC3701 OPTICAL COMMUNICATION

Course Objective:

This course provides comprehensive idea about

1. Principle and working of optical communication system.
2. Operation and characteristics of optical sources and detectors.
3. Optical Power and Link Design.

Learning Outcome:

At the end of the course students will be able to gain knowledge about the

1. Fundamentals of optical communication.
2. Advantages of optical communication over other means of communication.
3. Principles of optoelectronic devices.
4. Optical Link setup, WDM and OTDR.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of Optical Communication** Introduction: Block diagram of optical fiber communication System: Advantages of optical fiber communication, Optical fiber wave guides, Ray theory transmission, Optical fiber Modes and configuration, Mode theory for circular Waveguides. Step Index fibers, Graded Index fibers. Single mode fiber: Mode Field Diameter, Effective Refractive Index. Fiber Material and its Fabrication Techniques.	30 Hours	1
II	**Optical Losses** Transmission Characteristics of Optical fiber: Attenuation in optical fibers, intrinsic and extrinsic absorption, linear and nonlinear scattering losses, Fiber bends losses, Dispersion and pulse broadening. Dispersion: Material dispersion, Wave-guide dispersion, Intermodal dispersion, intra-model dispersion. Optical fiber Connectors: Joints, Couplers and Isolators.	30 Hours	1

III	**Optical sources and Detectors** LEDs, Structures, Materials: Quantum efficiency, Power, Modulation, Power bandwidth product. Laser Diodes- Basic concepts, Classifications, Semiconductor injection Laser, Laser Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, resonant frequencies. Reliability of LED & ILD. Requirement for photo detections: PN photodiode, characteristics of photo detections, PIN and avalanche photodiodes, Comparison.	30 Hours	1
IV	**Optical Power and Link Design** Source to fiber power launching - Output patterns, Power coupling, Power launching: Equilibrium Numerical Aperture. Optical receiver operation- Fundamental receiver operation. Digital signal transmission, error sources. Receiver configuration: Digital receiver performance, Probability of error, Quantum limit, Analog receivers. Link Design: Point to Point Links, Power Penalties, Error control. Multichannel Transmission Techniques. WDM concepts and component overview. OTDR and Optical Power meter.	30 Hours	1

Text Books:

1. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition,2004.
2. John M. Senior, "Optical Fiber Communications", PEARSON, 3rd Edition, 2010.

Reference Books:

1. Gerd Keiser, "Optical Fiber Communications", TMH, 4th Edition, 2008.
2. Joseph C. Plais, "Fiber Optic Communication", Pearson Education, 4th Ed, 2004

BEC3702 DATA COMMUNICATION NETWORKS

Course Objective:

1. To understand the concept of data communication Networks.
2. To understand about different types of transmission media and network devices.
3. To provide the overall insight of complete computer networking paradigm, includes the concept of flow control, error control and LAN topologies.

Learning Outcome:

Students will

1. Learn the insight of layered OSI model.
2. Understand various wireless standards such as LAN, IEEE 802.x.
3. Know about the TCP/IP Protocol suite.
4. Learn Addressing, Sub netting and network layer protocols.
5. Know about application layer protocol and services.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**INTRODUCTION:** Network structure, Network architectures, The OSI reference model, Services and standardization, Connection oriented and connection less services. The Physical Layer: Transmission media, Pulse code modulation, FDM & TDM, Circuit switching, Packet switching, Hybrid switching, X.21, Ethernet.	30 Hours	1
II	**The Data Link Layer:** Basic link protocols, Character oriented and bit oriented protocols, The ALOHA protocols, IEEE standard 802 for LAN, Framing, Error control, Flow control.	30 Hours	1
III	**The Network Layer:** Design Issues. Routing Algorithms, Congestion control Algorithms, Subnet concept, Virtual circuit and Data gram Subnet, Flow control, Internetworking, Bridges,	30 Hours	1

	Routers, Gateways and different level switches.		
IV	**The Transport Layer:** Design Issues, Connection management, Study of Internet and ATM transport layer protocols, Internet Issues: Principles of bridges and routers. The TCP/IP Protocol suite: Overview of TCP/IP. Addressing, Subnetting and network layer protocols. Application layer services: DNS, DHCP, FTP, TFTP, SMTP, SNMP, HTTP, WWW.	30 Hours	1

Text Book:

1. B.A. Forouzan, "Data Communication and Networking", Tata McGraw Hill.

References:

1. William Stallings: Data & Computer Communication, Prentice Hall.
2. Andrew S. Tanenbaum: Computer Networks, PHI India.
3. Leon-Garcia, Widjaja: Communication Networks, TMH.

Generic Elective -II

GE33421 SATELLITE COMMUNICATION

Course Objective:

1. To introduce basic concept of Satellite communication and various aspects of satellite communication like orbital mechanics, launching techniques.
2. To know about satellite sub systems, satellite link design and propagation effects.
3. To discuss various applications of satellite communication system.

Learning Outcome:

At the end of this course students will demonstrate the ability to

1. Visualize the architecture of satellite systems as a means of high speed and high range communication system.
2. State various aspects related to satellite systems such as orbital equations, sub-systems ina satellite, link budget, propagation effects and various applications of satellite system.
3. Solve numerical problems related to orbital motion and design of link budget for thegiven parameters and conditions.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Elements of Satellite Communication** Overview of Satellite Communication, Frequency Allocation for Satellite Communication, Kepler's Law, Definition of terms for Earth Orbiting Satellite: Apogee and Perigee Heights, Look Angle Determination. Orbital Perturbations, Launches and Launch Vehicles, Orbital Effects in Communication Systems Performance.	30 Hours	1
II	**Satellite Subsystems** Attitude and Orbit Control System, Telemetry, Tracking, Command and Monitoring, Power System, Communication Subsystems: Description, Transponders. Satellite Antennas.	30 Hours	1

III	**Link Design and Propagation Effect** Factors effecting Satellite Design, Basic Transmission Theory: Link Power Budget Equation. System Noise Temperature and G/T Ratio, Attenuation and Depolarization, Atmospheric Absorption, Rain and Ice Effect.	30 Hours	1
IV	**Satellite Services** VSAT: Network Architecture, Access Control Protocol, Basic Technique, VSAT Earth Station. Direct Broadcast Satellite: Digital DBS TV, Error Control and Master Control Station. Global Positioning System: Principle of GPS, GPS Receivers and Codes. Satellite Signal Acquisition	30 Hours	1

Text Book :

1. B. Pratt, A. Bostian, “Satellite Communications”, Wiley India.
2. D. Roddy, “Satellite Communications”, TMH, 4th Ed.

Reference Book:

1. S. D. Ilcev, “Global Mobile Satellite Communication”, Springer
2. R. Pandya, “Mobile and Personal Communication Systems and Services ”, PHI.

GE33422 INTRODUCTION TO RADAR SYSTEMS

Course Objective:

1. To make students understand the basic concept of Radar.
2. To study the principle of Radar and different types of Radar.
3. To learn tracking with Radar.
4. To study about the detection of signals and propagation of Radar waves.
5. To study the concept of Navigation system through Radar.

Learning Outcome:

Students will be able to

1. Know the concept of Radar and its application.
2. Detect the Signal in Noise at Receiver.
3. Know about Radar system and its components.
4. Solve the problems related to the Range of Radar.
5. Know the concept of navigation system through Radar.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Radar** Basic Radar: Simple form of Radar Equation, Radar Block Diagram, Radar Frequencies, Applications of Radar, Detection of Signals in Noise: Receiver Noise, Signal to Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross-section of Targets, Radar Cross-Section Fluctuations, Transmitter Power, Pulse Repetition Frequency, Antenna Parameters, System Losses.	30 Hours	1
II	**MTI , Pulse Doppler and Tracking Radar** Introduction to Doppler and MTI Radar: Doppler Frequency, Continuous Doppler Radar, Pulse Doppler Radar, MTI Radar, Delay Line Cancellers, Doppler Filter Banks, Digital MTI Processing, Limitations to MTI Performance, Moving Target Detector, Tracking with	30 Hours	1

	Radar: Mono pulse Tracking, Conical and Sequential Lobing, Low angle Tracking, Comparison of Trackers.		
III	**Radar Signal Detection and Information** Detection Criteria, Detectors, Automatic Detection, Constant False Alarm Rate Receivers, Basic Radar Measurements, Pulse Compression, Target Recognition, Clutter: Types of Clutter, Detection of Targets in Clutter, Basic of Radar Transmitter, Basic of Radar Receiver.	30 Hours	1
IV	**Propagation and Radar Navigation** Propagation of Radar Waves: Forward Scattering from a Flat Earth, Scattering from Round Earth's Surface, Basic of Standard and Non Standard Propagation, Diffraction and Attenuation, Other Propagation Effects, Directional Finder, Navigation System: Decca Navigation System, Tactical Air Navigation, Ground Controlled Approach.	30 Hours	1

Text Book:

1. Merrill I. Skolnik "Introduction to Radar Systems" Third Edition, McGraw Hill.
2. N.S. Nagaraja "Elements of Electronic Navigation" 2nd Edition, Tata McGraw Hill.

Reference Book:

1. J.C. Toomay , Paul J. Hannen " Principles of Radar" Third Edition.
2. Nadav Levanon, "RADAR Principles", John Wiley and Sons.

GE33423 INTRODUCTION TO OPTOELECTRONICS

Course Objective:

Course gives the comprehensive idea about

1. The principle of electro optic effect.
2. Optical processing, Optical sensors and Optical modulators as well as their working.
3. Optical wave guide, Optical computing and arithmetic operations.

Learning Outcome:

At the end of the course students will be able to gain knowledge about

1. Performance of optical modulators and optical sensors.
2. Different type of optical sensor operation.
3. Optical computing and their arithmetic.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction and Electro optic effect** Introduction to Optical waveguide, Photo sources, Photo detectors, Optical waveguide modes, Theory of dielectric slab waveguides, Symmetric & Asymmetric slab wave guide, Birefringence phenomenon, Electro optic Retardation, Electro optic amplitude, Phase modulator, Electro optic intensity modulators, Beam deflection, Acousto –optics, acousto –optics modulators, Integrated optic spectrum analyzer, Nonlinear optics second harmonic generation, Parametric amplification.	30 Hours	1
II	**Fourier Optics** Phase transformation of thin lens, Fourier transforming property of Lens, Image forming property of Lens, Interferometer, Optical data storage, Speckle Phenomenon, Laser Interferometer.	30 Hours	1
III	**Optical Fiber Sensors** Multimode fiber Sensors: Displacement, pressure, stress,		

	strain. Intensity modulated sensors, Active multimode fiber optics sensors, Micro-bend optical fiber sensor, Magnetic sensors, Single mode fiber, optics sensors, Polarization modulated sensors, Fiber optic Gyroscope.	30 Hours	1
IV	**Optical Computing and Arithmetic Operations** Analog linear optical processing, Halftone processing, Nonlinear processing, Analog arithmetic operation: Addition, Subtraction, Multiplication, Division, Averaging, Differentiation and integration. Digital Logic: Modified signed digit number system, Residue Number system, Logarithmic number system. Arithmetic Operation: Residue, Signed logarithmic arithmetic, Threshold logic, Threshold devices, Spatial light Modulators, Theta Modulation devices.	30 Hours	1

Text Books:

1. Mohammad A. Karim , Abdul As Awwal , “Optical Computing –An introduction”, Wiley, Reprint 1992.
2. F.T.S. Yu, “Optical Information Processing”, John Wiley, New York, Reprint 1983.

Reference Books:

1. J. Wilson, J.F.B. Hawkes k, “Opto Electronics: An Introduction”, PHI, Second Edition Reprint 2000.
2. I.P. Kaminov , “A Introduction to Electro Optic Devices”, Academic Press New York, Reprint 1974.
3. A Yariv , “ Optical Electronics”, C.B.S. Collage Publishing, New York, Reprint 1985.

GE33424 INTRODUCTION TO MATLAB

Course Objective:

1. To provide basic knowledge about the simulation platform.
2. To impart basic knowledge of programming for problem solution.
3. To provide knowledge about GUI and other tools that is important for engineering computation.

Learning Outcome:

1. Students will learn basics of MATLAB and how to use MATLAB in simulation.
2. Students will understand MATLAB as a tool for technical computing, computation and visualization in an integrated environment.
3. Students will be able to create GUI for performing specific task.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to MATLAB** Advantages of MATLAB, Disadvantages of MATLAB, MATLAB Environment, Variables and Arrays, Initializing Variables in MATLAB, MATLAB Basics, Multidimensional Arrays, Sub-arrays, Special Values, Displaying Output Data, Data Files, Scalar and Array Operations, Hierarchy of Operations, Built-in MATLAB Functions, Introduction to Plotting.	30 Hours	1
II	**Branching Statements and Program Design** Introduction to Top-Down Design Techniques, Use of Pseudo-code, The Logical Data Type, Relational Operators, Logic Operators, Logical Functions, Branches, if Construct, the switch Construct, the try/catch Construct Additional Plotting Features: Controlling *x*- and *y*-axis Plotting Limits, Plotting Multiple Plots on the Same Axes, Creating Multiple Figures, Subplots, Annotating and Saving Plots.	30 Hours	1
III	**Loops:** while Loop, for Loop: Details of Operation: MATLAB Just-in-Time (JIT) Compiler, break and	30 Hours	1

	continue Statements, Nesting Loops, Logical Arrays and Vectorization, Creating the Equivalent of if/else Constructs with Logical Arrays **User-Defined Functions:** Introduction to MATLAB Functions, Variable Passing in MATLAB: The Pass-by-Value Scheme, Optional Arguments, Sharing Data Using Global Memory, Preserving Data between Calls to a Function, Function Functions, Sub-functions, Private Functions, and Nested Functions.		
IV	**Graphical User Interfaces** How a Graphical User Interface Works, Creating and Displaying a Graphical User Interface, Object Properties, Graphical User Interface Components, Static Text Fields, Edit Boxes, Pushbuttons, Toggle Buttons, Checkboxes and Radio Buttons, Popup Menus, List Boxes, Sliders, Additional Containers: Panels and Button Groups, Panels, Button Groups, Dialog Boxes, Menus etc.	30 Hours	1

Text Books:

1. Stephen J. Chapman "MATLAB Programming for Engineers" 4th Edition, Thomson.
2. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, Rudra Pratap, Paperback – 2010.

Reference Books:

1. Solving Engineering Mechanics Problems with MATLAB, Dukkipati, Rao V
2. Applied Numerical Methods Using MATLAB, Dukkipati, Rao V

Generic Elective – III

GE33431 VLSI DESIGN

Course Objective:

1. To teach fundamentals of VLSI circuit design and implementation using circuit simulators and layout editors.
2. To highlight the circuit design issues in the context of VLSI design.
3. To demonstrate a clear understanding of CMOS fabrication flow and technology scaling.

Learning Outcome:

1. To design MOSFET based logic circuit.
2. To draw layout of a given logic circuit.
3. To realize logic circuits with different design styles.
4. To understand the working principle and operation of different types of memories.
5. To understand the working principles of clocking, power reduction and distribution.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of VLSI Design Methodologies** VLSI Design Flow, Design Hierarchy, Concepts of Regularity, Modularity and Locality. MOSFET Fabrication: Fabrication process flow, NMOS and CMOS fabrication, Layout design rules, Stick diagram and mask layout design. MOS Transistor: MOS Structure, The MOS System under external bias, Operation of MOSFET, MOSFET - Current / Voltage Characteristics, Scaling and Small geometry effects and capacitances.	30 Hours	1
II	**CMOS Technology** MOS Inverters: Introduction, Resistive Load Inverter,	30 Hours	1

	Inverters with n-type MOSFET load, CMOS Inverter. MOS Inverters - Switching Characteristics, Delay – Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints. Combinational MOS Logic Circuits: Introduction, MOS logic circuits with depletion NMOS Loads.		
III	**CMOS logic circuits & Memory** CMOS logic circuits, Complex logic circuits. CMOS transmission gates (pass gates) Sequential MOS Logic Circuits: Introduction, Behavior bistable elements, SR latch circuits, Clocked latch and FF circuits, CMOS D latch and edge triggered FF. Dynamic logic circuits: Introduction, Basic principle of pass transistor circuits, Synchronous dynamic circuit techniques, Dynamic CMOS circuit techniques, Domino CMOS logic. Semiconductor memories: Introduction, DRAM, SRAM, ROM, flash memory.	30 Hours	1
IV	**Low power CMOS Logic Circuits and Testing** Low power CMOS Logic Circuits: Introduction, Overview of Power Consumption, Low – Power Design through voltage scaling, Estimation and Optimization of switching activity, Reduction of Switched Capacitance and Adiabatic Logic Circuits. Design for Testability: Introduction, Fault Types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based and BIST Techniques.	30 Hours	1

Text Book:

1. Sung-Mo Kang &Yosuf Leblebici, “CMOS Digital Integrated Circuits: Analysis & Design”, TMH, 3rd Edition.

Reference Books:

1. D. A. Pucknell and K. Eshraghian, “Basic VLSI Design: Systems and Circuits”, PHI, 3rd Ed., 1994.
2. W. Wolf, Modern VLSI Design: System on Chip, Third Edition, Pearson, 2002

GE33432 INTRODUCTION TO WIRELESS SENSOR NETWORKS

Course Objective:

1. The main objective of this course is to give the basic knowledge about the related concepts and applications of Wireless Sensor Networks.
2. To provide the idea about the fundamentals of wireless communication system used in wireless sensor network with relevant protocols and design issues.

Learning Outcome:

1. At the end of the course students will have clear understanding of WSN network architectures, its characteristics, critical design factors, and constraints.
2. They will gain the understanding of various medium access control (MAC) protocols for WSNs.
3. Students will learn about various routing protocols and their challenges. They will also understand the principle of localization and time sync issues.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview Of Wireless Sensor Networks** Relationship between Wireless Ad-Hoc Network & Wireless Sensor Network, WSN Architecture and Protocol Stack , WSN Applications, Factors Influencing WSN Design: Hardware Constrains-Fault Tolerance-Scalability-Production Costs-WSN Topology, Transmission, Media, Power Consumption	30 Hours	1
II	**Physical Layer and Medium Access Control** Physical Layer Standard: 802.15.4, Challenges for MAC, CSMA Mechanism, Contention Based MAC Protocols: S-MAC-B-MAC, Reservation Based Medium Access: TRAMA, Hybrid Medium Access: Zebra MAC	30 Hours	1
III	**Network Layer and Transport Layer** Challenges For Routing, Data centric and Flat-Architecture Protocol: Flooding-Gossiping-Sensor Protocols for Information via Negotiation (SPIN)-Directed Diffusion, Hierarchical Protocols: LEACH-PEGASIS **Communication with internet:**	30 Hours	1

	Design Principles for WSNs Gateway Concepts – Need for gateway – WSN to Internet Communication –Internet to WSN Communication –WSN Tunneling		
IV	**Time Synchronization and Localization** Challenges for Time Synchronization, Network Time Protocol, Timing-Sync Protocol for Sensor Networks (TPSN), Reference-Broadcast Synchronization (RBS), Challenges in Localization, Ranging Techniques, Range-Based Localization Protocols	30 Hours	1

Text Books:

1. I.F. Akyildiz& M.C. Vuran, " Wireless Sensor Networks".
2. Holger Karl and Andreas Wiilig, "Protocols and Architectures for Wireless SensorNetworks" John Wiley & Sons Limited 2008.
3. I.F .Akyildiz and Weillian, "A Survey on Sensor Networks", IEEE Communication Magazine, August 2007.

Reference Books:

1. Demin Wang and Dharma P. Agrawal, "Wireless Sensor Networks: Deployment Alternatives and Analytical Modeling," book published by Lambert Academic, 2010.
2. Jung Hyun Jun, Bin Xie, and Dharma P. Agrawal, "Wireless Mobile Sensor Networks," book chapter edited by Sudip Misra, Handbook of Wireless Ad Hoc and Sensor Networks (Springer).
3. K. Soraby& D. Minoli, "Wireless Sensor Networks" Wiley.

GE33433 EMBEDDED SYSTEMS

Course Objective:

1. To provide the basics of embedded system.
2. To study the designing of embedded system with microcontrollers.
3. To introduce designing using Real time OS.
4. To introduce various software development tools.

Learning Outcome:

Student will learn

1. The basics of embedded system.
2. Designing of embedded system with microcontrollers.
3. Designing using Real time OS.
4. Various software development tools.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to embedded systems** History of Embedded Systems, Classification of embedded system, Major application and areas of embedded system, Innovative bonding of life style with embedded technology. Typical embedded system: Core of embedded system, Memory, Sensors and actuators, communication interface, Embedded firmware, PCB and passive components, Characteristics of embedded system, Quality attributes of embedded system.	30 Hours	1
II	**Designing embedded system with microcontroller** Factors to be considered in selecting controller, 8051 microcontroller, Designing with 8051, 8052 microcontroller, Addressing modes supported by microcontroller, 8051 instruction set, Fundamental issues in Hardware software co design, computational models in embedded Design, Introduction to unified modeling language, Hardware software trade off.	30 Hours	1
III	**Basic design using real time operating system** Introduction to real time operating system: Task and Task	30 Hours	1

	state, Task and Data, Semaphores and shared data. Design of RTOS: Encapsulating Semaphores and queues, Hard real time Scheduling memory space, Saving power.		
IV	**Embedded Software development tools** Host and target machines, linker / locators for embedded software, Getting embedded software in to target system, Debugging techniques, Testing on your host machines, Instruction set Simulator, Assert macro, Using laboratory tools.	30 Hours	1

Text Books:

1. An Embedded Software Primer-David E Simon,Pearson,1999
2. Shibu K V ,"Introduction to Embedded Systems",TMH

Reference books:

1. H. Kopetz, "Real Time Systems", Kluwer

GE33434 POWER ELECTRONICS

Course Objective:

1. To introduce students to the basic theory of power semiconductor devices and passive components, their practical applications in power electronics.
2. To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications.
3. To provide strong foundation for further study of power electronic circuits and systems.

Learning Outcome:

1. Describe the role of Power Electronics as an enabling technology in various applications such as flexible production systems, energy conservation, renewable energy, transportation etc.
2. Using the average model of the building block, quickly simulate the dynamic performance of dc-dc converters and compare them with their switching counterparts.
3. Learn the role of Power Electronics in utility-related applications which are becoming extremely important.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Power semiconductor devices: Introduction: Concept of Power Electronics, scope and applications, desired Characteristics of controllable switches Power semiconductor switches and their characteristics: Power Diode, Power BJT, Power MOSFET, IGBT, SCR, TRIAC, GTO.	30 Hours	1
II	Thyristor: Rating & protection, Methods of SCR commutation, Gate Drive Circuit, Series and Parallel operation. DC-DC Converters: Introduction, Control Strategies, Buck converter, Boost Converter, Buck-Boost converter, Analysis of buck converter, Switched Mode power Supply (SMPS).	30 Hours	1
III	Phase Controlled Converters: Single phase half wave controlled rectifier with various loads, Effect of freewheeling diode. Single phase fully controlled and half controlled bridge converters with various loads. Performance Parameters of single phase uncontrolled and controlled converters. Three phase half wave converters, Three phase fully	30 Hours	1

	controlled and half controlled bridge converters, Effect of source impedance, Single phase and three phase dual converters		
IV	AC Voltage Controllers: Principle of On-Off and phase controls, Single phase ac voltage controller with resistive and inductive loads, sequence control. Inverters: Single phase and Three phase bridge inverters, VSI, CSI, Voltage control of single phase inverters, PWM Techniques, Introduction to Multi level inverter.	30 Hours	1

Text Books:

1. M.H. Rashid, "Power Electronics: Circuits, Devices & Applications", Pearson India, 4th Edition,2018.
2. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd,2008
3. P.C. Sen, " Power Electronics", McGraw Hill Education (India) Pvt. Ltd.

Reference Books:

1. P.S. Bhimbra, " Power Electronics", Khanna Publishers.
2. M.S. Jamil Asghar, "Power Electronics" Prentice Hall of India Ltd., 2004
3. Chakrabarti &Rai, "Fundamentals of Power Electronics &Drives", Dhanpat Rai &Sons.
4. V.R. Moorthy, " Power Electronics : Devices, Circuits and Industrial Applications" Oxford University Press,2007
5. S.N. Singh, "A Text Book of Power Electronics" Dhanpat Rai & Sons

BEC3751 CAD OF ELECTRONICS LAB

1.

a) Transient Analysis of BJT inverter using step input.
b) DC Analysis (VTC) of BJT inverter with and without parameters.

2.

a) Transient Analysis of MOS inverter using step input.
b) Transient Analysis of NMOS inverter using pulse input.
c) DC Analysis (VTC) of NMOS inverter with and without parameters.

3.

a) Analysis of CMOS inverter using step input.
b) Transient Analysis of CMOS inverter using step input with parameters.
c) Transient Analysis of CMOS inverter using pulse input.
d) Transient Analysis of CMOS inverter using pulse input with parameters.
e) DC Analysis (VTC) of CMOS inverter with and without parameters.

4. Transient & DC Analysis of NOR Gate inverter.
5. Transient & DC Analysis of NAND Gate.
6. Synthesis and simulation of Full Adder.
7. Synthesis and Simulation of Full Subtractor.
8. Synthesis and Simulation of 3 X 8 Decoder.
9. Synthesis and Simulation of 8 X 1 Multiplexer.

BEC3752 ELECTRONICS CIRCUIT DESIGN LAB

In this practical course students will carry out a design oriented project work using various analog/ digital building blocks which they have already studied in their analog electronic/digital electronic courses such as Electronic circuits, integrated circuits and filter design. The project may include but not restricted to any of the following:

1. Universal op-amp based biquad.
2. Universal OTA biquad.
3. Amplitude control or stabilization applied to any sinusoidal oscillators.
4. Op-amp/ OTA based function generator.
5. Any application of log/antilog circuits.
6. Any applications of analog multiplier/ divider.
7. Any digital system design and its hardware implementation using TTL/ CMOS ICs.
8. Any circuit idea (not studied in the course) using 555 Timer in conjunction with any other ICs.

The above must include

1. Design the circuit.
2. Make hardware and measure various parameters.
3. Simulation in Spice of the designed circuit.
4. Comparison of measured and simulated results.
5. A report is to be made for evaluation.

BEC2801 WIRELESS COMMUNICATION

Course Objective:

1. To study the concept of wireless communication and mobile radio propagation environment.
2. To know about various signal improvement techniques such as diversity and equalization.
3. To have overview of immerging technologies for Wireless standards.

Learning Outcome:

1. Student will learn the basics of wireless communication and spread spectrum techniques.
2. Student will be able to perform the cellular planning for mobile communication.
3. Understand evolution of mobile communication generations 2G, 2.5G, 3G with their characteristics and limitations.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Wireless Communication System and Mobile Radio Communication.** Evolution of mobile radio communication fundamentals, Large scale path loss: Propagation models, Reflection, Diffraction, Scattering, Practical link budget design using path loss model. Small scale fading. Multipath propagation and measurements. Impulse response model. Parameters of multipath channels, Types of small scale fading, Theory of multi-path shape factor for fading wireless channels.	30 Hours	1
II	**Modulation Techniques, Equalization, Diversity.** Spread spectrum modulation techniques: Pseudo-noise sequence, Direct sequence spread spectrum (DS-SS), Frequency hopped spread spectrum(FH-SS), Performance of DS-SS, Performance of FH-SS. Modulation performance in fading and multipath	30 Hours	1

	channels. Fundamentals of equalization: Equaliser in communication receiver, Survey of equalisation techniques, Linear equalizer, Non-linear equalization. Diversity techniques. RAKE receiver.		
III	**Speech Coding and Multiple Access Techniques** Characteristics of speech signals, Quantization techniques, Vocoders, Linear predictive coders, Introduction to multiple access: Time division multiple access, Space division multiple access, Frequency division multiple access.	30 Hours	1
IV	**The Cellular Concept, Wireless networks and Standards.** Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Introduction to wireless networks, 2G, 3G wireless systems, Wireless standards.	30 Hours	1

Text Book:

1. T.S. Rappaport, “Wireless Communication-Principles and practice”, Pearson

Reference Books:

1. Willium C. Y. Lee, “Mobile communication Design and fundamentals”
2. D. R. KamiloFehar, “Wireless digital communication”
3. Haykin S &Moher M., “Modern wireless communication”, Pearson, 2005

Generic Elective - IV

GE33441OPTICAL NETWORKS

Course Objective:

1. To study coverage of the basic principles of optical networks and its components.
2. To study about different types of optical networks.
3. To study the concept of Wavelength Division Multiplexing (WDM) schemes.
4. To study the different types of protection schemes in optical network.
5. To study the various types of switching and other mechanism used in optical network.

Learning Outcome:

This course enables the students to

1. Understand the fundamental principles of light wave in optical network.
2. Identify structures, functions, materials, and working principle of light sources, couplers, detectors, and multiplexers
3. Design optical fiber communication links using appropriate optical fibers, light sources, couplers, detectors, and multiplexers.
4. Understand the various issues in designing of WDM networks.
5. Conceptualize the Packet switched network (PPS) capable of providing packet switched services at the optical layer.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Optical Networks and its component** Principles of Optical Network and its Generation, Characteristics of Optical Fiber: Self-Phase Modulation, Cross-Phase Modulation, Four-Wave Mixing.Optical Packet Switching, Transmission Basics, Multiplexers & Filters: Gratings- Bragg Grating, Fiber Grating, Fabry-Perot Filters, Mach-Zehnder Interferometers, Arrayed Waveguide Grating. Optical Amplifiers, Tunable Lasers, Switches, Wavelength Converters, Introduction to soliton systems.	30	1

II	**Networks** Synchronous Optical Network(SONET) / Synchronous Digital Hierarchy (SDH)- Introduction, SONET/SDH Multiplexing, SONET/ SDH Layers and Frame Structure, Elements of a SONET/SDH Infrastructure. Optical Transport Network, Generic Framing Procedure, Internet Protocol, Ethernet, Wave Division Multiplexing (WDM) Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/ Drop Multiplexers, Optical-Crossconnects.	30	1
III	**WDM Network Design, Survivability and Introduction to Access Network** WDM Network Design: Cost Trade-offs, Light path Topology Design, Routing and wavelength assignment problems, Wavelength Conversion. Network Survivability: Basic Concepts, Protection in SONET/SDH, Protection in client layer, Optical Layer Protection, Interworking between Layers. Access Networks: Network Architecture Overview, Enhanced HFC, FTTC, PON evolution	30	1
IV	**Optical Switching and Deployment Considerations** Optical Time Division Multiplexing (OTDM): Synchronization, Header Processing, Buffering (Output and Input Buffering), Burst Switching. Deployment Considerations: SONET/SDH core Network, Architectural Choices for Next-Generation Transport Networks.	30	1

Text Books:

1. R. Ramaswami, & K. N. Sivarajan, "Optical Networks a Practical Perspective", Morgan Kaufmann Publishers, 3rd Ed.
2. U. Black, "Optical Networks: Third Generation Transport Systems" Pearson Educations.

Reference Books:

1. Biswanath Mukherjee "Optical WDM Networks" Springer Pub 2006.
2. Murthy, C. Siva Ram & Gurusamy, Mohan "WDM Optical Networks Concepts, Design & Algorithms" / Prentice Hall (India)
3. Keiser, "Optical Fiber Communication Systems", 4th edition, TMH.

GE33442 INTERNET OF THINGS

Course Objective:

1. To provide basic knowledge about IOT technology.
2. To impart basic knowledge of programming.
3. To provide knowledge about various existing MAC protocol and wireless technologies

Learning Outcome:

1. Students will learn basics of internet of things.
2. Students will understand about the various MAC protocol and various wireless standards that are functional today.
3. Students will be able to learn the basic programming which is necessary to build up the IOT application.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to the Internet of Things (IoT) :**What is the Internet of Things (IoT)? , Technology drivers, Business drivers, Typical IoT applications, Trends and implications, IoT Architectures: Architectures for IoT, Elements of an IoT Architecture, Architectural design considerations.	30 Hours	1
II	**IoT Network protocols (MAC layer):** Wireless sensor networks (WSNs) and power consumption, CSMA/CA and slotting, Centralized vs. distributed, State-of-the-art MAC-layer protocols for WSNs	30 Hours	1
III	**Wireless technologies for IoT (Layer 1 & 2):** WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems	30 Hours	1
IV	**IoT application programming:** Introduction to IoT device programming, IoT application development, Data	30 Hours	1

	analytics for IoT: A framework for data-driven decision making, Descriptive, Predictive and Prescriptive Analytics, Business Intelligence and Artificial Intelligence, Importance of impact and open innovation in data-driven decision making.		

Text Books:

1. Internet of Things by Srinivasa K.G. , Siddesh G.M., Hanumanta Raju R. (Cengage Delmar Learning India Pvt) 2018 edition
2. The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
3. Wireless sensor networks: an information processing approach by Feng Zhao, and Leonidas J. Guibas.(Morgan Kaufmann) First edition 2004.

Reference Books:

1. Karl Holger and Andreas Willig ”Protocols and architectures for wireless sensor networks”. John Wiley & Sons.
2. Dargie, Waltenegus W., and Christian Poellabauer. Fundamentals of wireless sensor networks: theory and practice. John Wiley & Sons.

GE33443 INFORMATION THEORY AND CODING

Course Objective:

1. Understand the difference between "data" and "information" in a message.
2. Learn how to analyze and measure the information per symbol emitted from a source**.**
3. Learn how to analyze the information-carrying capacity of the communication channel.
4. Learn how to design source compression codes to improve the efficiency of information transmission.
5. Learn how to adapt and tailor known error control codes for use in particular applications.
6. Learn the basic theory needed for data encryptions.

Learning Outcome:

1. The student will understand the basics of information theory and coding techniques.
2. The student will determine the minimum number of bits per symbol required to represent the source and the maximum rate at which a reliable communication can take place over the channel.
3. The student will learn about cyclic codes.
4. The student will understand the concept of convolution codes, their encoding as well as decoding.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Information Theory and Source Coding** Definition of Information: Entropy, Information Rate, Discrete, Memory less Channel, Mutual Information, Channel Capacity, Shannon's Theorem, Shannon-Fano Algorithm, Huffman Coding.	30 Hours	1
II	**Linear Block Codes** Introduction to Error Control Coding, Error Detection: Redundancy, Parity Check, Cyclic Redundancy Check	30 Hours	1

	(CRC), Checksum. Error Correction: Automatic Repeat Request (ARQ), Forward Error Correction (FEC). Hamming Code.		
III	**Cyclic Codes** Polynomial representation of code words, Generator polynomial of a cyclic code, Cyclic codes in systematic format, Generator Matrix of a cyclic code, Encoder for a cyclic code, Decoding of a cyclic code.	30 Hours	1
IV	**Convolution Codes** Introduction, Convolution Encoder Representations: Representation of Connections, State Diagram Representation, Trellis Representation. Decoding: Viterbi Algorithm, Sequential Decoding.	30 Hours	1

Text Books:

1. J. C. Moreira & P.G. Farrell, “Essentials of Error Correcting Codes” John Wiley
2. Communication Systems: Analog and Digital, R Singh,S. Sapre, McGraw Hill

Reference Books:

1. Robert G. Gallagar, “Information Theory And Reliable Communication”, John Wiley.
2. Simon Haykin , “Digital Communication” , John Wiley , Fourth Edition, Reprint 2009.
3. B.P Lathi, “Modern Digital & Analog Communication Systems”, Oxford University Press, Fourth Edition, 2010.
4. Taub& Schilling, “Principles of Communication Systems”, TMH.

GE33444 ARTIFICIAL NEURAL NETWORK

Course Objective:

The objectives of this course are to:

1. Understand the role of neural networks in engineering, artificial intelligence, and cognitive modeling.
2. Provide knowledge of supervised learning in neural networks.
3. Provide knowledge of computation and dynamical systems using neural networks.
4. Provide knowledge of reinforcement learning using neural networks.

Learning Outcome:

1. Feed-forward neural networks of increasing complexity, gradient descent learning and extensions, learning and generalization theory.
2. Have an understanding of the concepts and techniques of neural networks through the study of the most important neural network models.
3. Be able to apply neural networks to particular applications, and to know what steps to take to improve performance.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction and history, human brain, biological neuron, models of neuron, signal flow graph of neuron, feedback, network architecture, knowledge representation, Artificial intelligence and neural networks. Learning Process Error correction learning, memory based learning, Hebbian learning, competitive learning, Boltzmann learning, learning with and without teacher, learning tasks, memory and adaptation.	30 Hours	1
II	Artificial neurons, Neural networks and architectures Introduction, neuron signal function, mathematical preliminaries, Feed forward& feedback architecture. Geometry of Binary threshold neurons and their networks Pattern recognition, convex sets and convex hulls, space of Boolean functions, binary neurons for pattern classification, non linear separable problems, capacity of TLN, XOR solution. Perceptrons and LMS Learning	30 Hours	1

	objective of TLN, pattern space & weight space, perceptron learning algorithm, perceptron convergence theorem, pocket algorithm, α – LMS learning, MSE error surface, steepest descent search, μ – LMS and application. Backpropogation and other learning algorithms. Multilayered architecture, back propagation learning algorithm, practical considerations, structure growing algorithms, applications of FFNN, reinforcement learning.		
III	Statistical Pattern Recognition Bayes' theorem, classical decisions with bayes' theorem, probabilistic interpretation of neuron function, interpreting neuron signals as probabilities, multilayered networks & posterior probabilities, error functions for classification problems. RBF Networks Regularization networks, generalized RBF networks, RBF network for solving XOR problem, comparison of RBF networks & multilayer perceptrons. Stochastic Machines Statistical mechanics, simulated annealing, Boltzmann machine.	30 Hours	1
IV	Adaptive Resonance Theory Building blocks of adaptive resonance, ART 1. Self Organizing Feature MAP Introduction, Maximal eigenvector filtering, principal component analysis, generalized learning laws, competitive learning, vector quantization, maxican hat networks, SOFM, applications of SOFM.	30 Hours	1

Text/ Reference Books:

1. Simon Haykin, "Neural Networks,", Pearson Education 2nd edition.
2. Satish Kumar, "Neural Networks," Tata McGraw-Hill.
3. Jack M. Zurada, " Introduction to Artificial Neural System," Jaico Publishing House.

Generic Elective - V

GE33451 ELECTRONICS SWITCHING

Course Objective:

1. To introduce basic principles of telecommunication switching and their evolution.
2. To study of space division switching and time division switching.
3. To develop understanding about problem of congestion, blocking probability during the designing of telecommunication system.
4. To provide knowledge about telephone networks as well as data networks.

Learning Outcome:

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

1. Understand evolution and basics of switching system.
2. Modeling of telecommunication network and factors affecting them like GOS and blocking probability.
3. Analyze telephone network and data network and also about the interdependency of both networks.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Evolution of switching system** Introduction: Simple telephone communication. Basics of switching system: Signaling tones, Strowger switching components, Crossbar switching system, Cross point technology, Touch tone dial telephone.	30 Hours	1
II	**Space division switching and Time division switching** Space division switching, SPC, Centralized SPC, Distributed SPC. Time division switching: Basic time division space switching, Basic time division time switching, Comparison of single stage and multistage network, Enhanced services.	30 Hours	1

III	**Telecom Traffic Engineering** Introduction: Network traffic load and parameters, Grade of service and blocking probability, Modeling switching systems, Incoming traffic and service time characterization, Blocking models and loss estimates, Delay systems.	30 Hours	1
IV	**Telephone networks and Data networks** Telephone networks: Subscriber loop system, Switching hierarchy and routing, Numbering plan, Charging plan, Signaling techniques, Common channel signaling, Data networks, Data transmission in PSTN, Switching techniques for data transmission, Circuit switching, Store and forward switching, ISO-OSI model.	30 Hours	1

Text books:

1. Thiagarajan Viswanathan, "Telecommunication switching System and networks", PHI.

Reference Books:

1. J.C. Bellamy, "Digital Telephony", John Wiley, 3rd Ed.
2. J.E. Flood, "Telecommunication switching, Traffic and Networks", Pearson education.

GE33452 TELEVISION ENGINEERING

Course Objective:

1. To study fundamental of television engineering.
2. To study television picture tubes, cameras and its broadcasting.
3. To study television receivers and circuits.
4. To study transmission and reception of color television.

Learning Outcome:

1. Students to have knowledge of basic concepts of television engineering.
2. To study characteristics of picture tubes and cameras.
3. Understand television receivers and its circuits.
4. Understand working of a color television.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Fundamentals of Television Engineering** Elements of Television system: Picture Transmission and reception, Sound Transmission and reception, Receiver controls, Analysis and Synthesis of Television Pictures: Gross Structure, Image Continuity, Number of scanning lines, Flicker, Fine Structure, Tonal Gradation, Composite Video Signals: Video Signal Dimensions, Horizontal and Vertical Sync details, Scanning sequence details, Functions of vertical pulse trains, Sync details of 525 line system, Signal Transmission and Channel Bandwidth: Amplitude Modulation and Channel Bandwidth, Vestigial Sideband, Transmission Efficiency, Frequency modulation and FM Channel Bandwidth, Channel bandwidth for color television, Allocation of frequency bands for TV Signal Transmission, Television Standards	30 hours	1

II	**Picture Tubes, cameras and broadcasting** Picture Tube: Monochrome picture tube, Beam deflection, Screen Phosphor, Face plate, Picture tube characteristics and circuit controls, Television Camera Tubes: Basic Principle, Image Orthicon, Vidicon, Plumbicon, Silicon diode array Vidicon, Solid state image scanners. Television broadcasting: Television studio, Television cameras, Program control room, Video switcher, Synchronizing system, Master control room, Generation of AM, Television transmitter, Positive and negative modulation, Sound signal modulation, Generation of FM, Stabilized reactance modulator, Generation of FM from PM, FM sound signal .	30 Hours	1
III	**Television Receiver and Circuits** Types of television receivers, Receiver sections, Video Detector: Video signal detection, Basic video detector, IF filter, Video detector requirements, Functions of composite video signals, Video section: Picture reproduction, Video amplifier operation, Automatic gain control and noise cancelling circuits: Advantages of AGC, Types of AGC, Delayed AGC, Noise cancellation, AGC adjustments, Sync separation circuits: Sync separator – Basic principle, Transistor sync separator, Noise in sync pulse, Transistor noise gate sync separator, Sync amplifier, Sync processing and AFC circuits: Sync waveform separation, Vertical and horizontal sync separation, Automatic frequency control, Vertical deflection circuit: Vaccum tube vertical deflection stage, Blocking oscillator driven output stage, vertical sweep module, Miller deflection circuit, Horizontal deflection circuit: Horizontal output stage, Sequence of operation, 'S' Correction, Output circuit stabilization, Transistor line output stage, Sound System, Sound signal separation, Sound take off circuits, AM limiting, FM Detection, Sound section integrated circuits, RF Tuner: Tuner operation, Basic coupling circuits, Types of tuners, Electronic tuning, UHF Tuners, Video IF Amplifiers,	30 Hours	1

	Video IF Section, IF Amplifiers, Vestigial sideband correction, IF sound section		
IV	**Color Television: Transmission and Reception** Essentials of color television: Compatibility, Natural Light, Color Perception, Three color theory, Luminance, Hue and Saturation, Polarity of color difference signals, Delta-gun color picture tube, Purity and convergence, Deflection unit, Precision-in-line color picture tube, Trinitron color picture tube, Automatic degaussing circuit, Color signal transmission, Modulation of color difference signal, Weighting factors, Formation of chrominance signal, Color television system: NTSC color receiver, PAL color system, PAL-D color system, SECAM system, Television applications: Cable television, Closed circuit television, Theatre television, Picture phone and facsimile, Video tape recording, Television via satellite, Television games.	30 Hours	1

Text Books:

1. R RGulati, " Monochrome and Colour Television", New Age International (P) Ltd Publishers, Revised Second Edition.
2. A.M. Dhake, "Television and Video Engineering", McGraw Hill Publications. 2008.

Reference Books:

1. B. Grob and C.E. Herndon, "Basic Television and Video Systems", McGraw Hill, 2008.
2. S.P. Bali, "Colour Television Theory and Practice", TMH, 2008.
3. G. Kennedy and B. Davis, "Electronic Communication Systems", Tata McGraw Hill Publishing Company Ltd., Fourth Edition.

GE33453 MICRO-ELECTRO-MECHANICAL SYSTEMS

Course Objective:

1. To introduce MEMS and micro fabrication.
2. To study the essential electrical and mechanical concepts of MEMS.
3. To know about the polymer MEMs.

Learning Outcome:

1. Students will gain basic knowledge on MEMS (Micro Electro Mechanical System).
2. Students will know about various fabrication techniques for MEMS.
3. Students will able to design, analyze and test the MEMs based components.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**INTRODUCTION** History of MEMs development, Intrinsic Characteristics of MEMs, Devices: sensors and actuators,	30 Hours	1
II	**INTRODUCTION TO MICROFABRICATION** Overview of Frequently used Micro Fabrication Process, Microelectronic Fabrication Process Flow, Silicon-Based MEMs Processes, Packaging and Integration	30 Hours	1
III	**REVIEW OF ESSENTIAL ELECTRICAL AND MECHANICAL CONCEPTS** Conductivity of Semiconductors, Crystal Planes and Orientation, Stress and Strain, Flexural Beam Bending Analysis Under Simple Loading Conditions, Torsional Deflections, Intrinsic Stress, Dynamic System, Resonant Frequency and Quality Factor.	30 Hours	1
IV	**POLYMER MEMS** Polymers in MEMs, Polyimide, SU-8, Liquid Crystal Polymer (LCP), PDMS, PMMA, Parylene, Fluorocarbon,	30 Hours	1

	Representative Applications, Acceleration Sensors, Pressure Sensors, Flow Sensors, Tactile Sensors.		

Text Books:

1. Chang Liu, “Foundations of MEMS”, Pearson Indian Print, 1st Edition, 2012.

Reference Books:

1. Gaberiel M. Rebiz, “RF MEMS Theory, Design and Technology”, John Wiley & Sons, 2003.
2. Julian W. Gardner and Vijay K Varadhan, “Micro-sensors, MEMS and Smart Devices”, John Wiley & sons, 2001.
3. Ian Sinclair, “Sensor and Transducers”, Elsevier India Pvt Ltd, 3rd Edition, 2011.

GE33454 INTRODUCTION TO DIGITAL IMAGE PROCESSING

Course Objective:

The objectives of this course are to:

1. Cover the basic theory and algorithms that are widely used in digital image processing
2. Expose students to current technologies and issues that are specific to image processing systems
3. Develop critical thinking about shortcomings of the state of the art in image processing
4. Understand the basic principles and methods of digital image processing,
5. Be able to formulate solutions to general image processing problems,

Learning Outcome:

1. Apply principles and techniques of digital image processing in applications related to digital imaging system design and analysis.
2. Analyze and implement image processing algorithms.
3. Gain hands-on experience in using software tools for processing digital images.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction: Fundamental steps in DIP, elements of DIP, Simple image model, sampling & quantization, basic relationships between pixels, colour image model.	30 Hours	1
II	Image Transforms, One-dimensional & two-dimensional DFT, cosine, sine, Hadamard, Haarand Slant& KL transforms, Image Enhancement : Introduction, point operations, histogram modelling, spatial operations.	30 Hours	1
III	Image Restoration: Introduction, image observation models, Inverse & Wiener filtering, difference between enhancement & restoration Restoration - spatial filtering, Noise reduction in frequency domain.	30 Hours	1
IV	Image Compressionand segmentation: Introduction to compression, Pixel coding, Predictive coding, Predictive	30 Hours	1

	coding, Transform coding, Inter-frame coding, introduction to image segmentation, Spatial feature extraction, Transforms features, Edge detection, Boundary extraction, Segmentation techniques.		

Text/Reference books:

1. Rafael C. Gonzalez Richard E Woods, "Digital Image Processing", Pearson, 3rd Ed. 2009.
2. Anil K Jain, "Fundamentals of Digital Image Processing", PHI