Curriculum and Syllabus

B. TECH.

Electronics and Communication Engineering

(Applicable for 2015-16 batch and onwards)

Department of Electronics and Communication Engineering
School of Engineering and Technology,
H. N. B. Garhwal (Central) University,
Srinagar Garhwal, Uttarakhand- 246174

Curriculum

Definitions/ Descriptions

1. Credit Equivalent

	No. of Contact Hours per Week	Equivalent Credits
Lecture+ Tutorial	**3 or 4**	**3**
Practical	**2**	**1**

2. Code for Courses:

Code for a course consists of two alphabets followed by three digits and an optional alphabet.

First three alphabet represent the school name (SET: School of Engineering and Technology) next two alphabets in the code represent the subject area of the course. E.g. (SH: Applied Science and Humanities, EC: Electronics and Communication Engineering, IN: Instrumentation Engineering,EE: Electrical Engineering, ME: Mechanical Engineering, CS: Computer Science and Engineering, IT: Information Technology, AECC: Ability Enhancement Compulsory Courses). Then there will be subject code with 4 letters out of which first will tell the nature of subject(C: Core/E: Elective/S: Skill Enhancement) and next three letters will tell the number according to the semester(for example 801 will tell its 8^{th} semester subject).First digit represents the semester. Next two digits represent the sequence number of course in the list of courses of a semester.

Mandatory Qualifying Courses and Elective Course:

Syllabus contains Mandatory Qualifying Courses to familiarize students with certain study areas/ disciplines of importance. Students have to complete and qualify mandatory qualifying course. Marks obtained for these courses are not to be added for calculating total Marks.
Elective courses are provided in VII and VIII semesters to provide student with flexibility to choose courses of their interest from a list of offered electives. These Electives are the courses offered by the same department or other departments for the students.

Semester-wise list of subjects

Semester I

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/SH/BT/C101	Mathematics I	3	1	-	4	3
2	SET/SH/BT/C102	Physics	3	1	-	4	3
	SET/SH/BT/C203	Chemistry					
3	SET/EE/BT/C103	Basic Electrical Engineering	3	1	-	4	3
	SET/ME/BT/C202	Basic Mechanical Engineering					
4	SET/EC/BT/C104	Basic Electronics	3	1	-	4	3
	SET/ME/BT/C204	Engineering Mechanics					
5	SET/IT/BT/C105	Fundamentals of Information Technology	3	1	-	4	3
	SET/CS/BT/C205	Computer Programming					
6	AECC106	*Environmental Science	2	-	-	2	2
7	SET/SH/BT/C106	Physics Lab	-	-	2	2	1
	SET/SH/BT/C207	Chemistry Lab					
8	SET/EE/BT/C107	Basic Electrical Engineering Lab	-	-	2	2	1
	SET/ME/BT/C206	Basic Mechanical Engineering Lab					
9	SET/IT/BT/C108	Information Technology Lab	-	-	2	2	1
	SET/CS/BT/C208	Computer Programming Lab					
10	SET/ME/BT/S109	**Engineering Graphics	-	-	4	4	2
Total			17	5	10	32	22

* Ability Enhancement Compulsory course.
**Skill Enhancement Course.

Semester II

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/SH/BT/C201	Mathematics II	3	1	-	4	3
2	SET/ME/BT/C202	Basic Mechanical Engineering	3	1	-	4	3
	SET/EE/BT/C103	Basic Electrical Engineering					
3	SET/SH/BT/C203	Chemistry	3	1	-	4	3
	SET/SH/BT/C102	Physics					
4	SET/ME/BT/C204	Engineering Mechanics	3	1	-	4	3
	SET/EC/BT/C104	Basic Electronics					
5	SET/CS/BT/C205	Computer Programming	3	1	-	4	3
	SET/IT/BT/C105	Fundamentals of Information Technology					
6	AECC206	*General English	2	-	-	2	2
7	SET/ME/BT/C206	Basic Mechanical Engineering Lab	-	-	2	2	1
	SET/EE/BT/C107	Basic Electrical EngineeringLab					
8	SET/SH/BT/C207	Chemistry Lab	-	-	2	2	1
	SET/SH/BT/C106	Physics Lab					
9	SET/CS/BT/C208	Computer Programming Lab	-	-	2	2	1
	SET/IT/BT/C108	Information Technology Lab					
10	SET/ME/BT/S209	**Engineering Workshop	-	-	4	4	2
Total			17	5	10	32	22

* Ability Enhancement Compulsory course.
**Skill Enhancement Course.

Semester III

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/SH/BT/C301	Mathematics III	3	1	-	4	3
2	SET/EC/BT/C302	Electronic Devices and Circuits	3	1	-	4	3
3	SET/EC/BT/C303	Digital Electronics	3	1	-	4	3
4	SET/IN/BT/C304	Signals and Systems	3	1	-	4	3
5	SET/IN/BT/C305	Circuit Theory	3	1	-	4	3
6	SET/EC/BT/C306	Electronic Devices and Circuits Lab	-	-	2	2	1
7	SET/EC/BT/C307	Digital Electronics Lab	-	-	2	2	1
8	SET/IN/BT/C308	Signals and Networks Lab	-	-	4	4	2
9	SET/EC/BT/S309	Electronics Servicing Lab*	-	-	4	4	2
Total			15	5	12	32	21

*Skill Enhancement Course.

Semester IV

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C401	Analog Integrated Circuits	3	1	-	4	3
2	SET/IN/BT/C402	Microprocessors and Interfacing	3	1	-	4	3
3	SET/EC/BT/C403	Analog Communication	3	1	-	4	3
4	SET/EC /BT/C404	Electromagnetic Field Theory	3	1	-	4	3
5	SET/IN/BT/C405	Electrical Measurements and Instrumentation	3	1	-	4	3
6	SET/EC/BT/C406	Analog Integrated Circuits Lab	-	-	2	2	1
7	SET/IN/BT/C407	Microprocessors and Interfacing Lab	-	-	2	2	1
8	SET/EC /BT/C408	Analog Communication Lab	-	-	2	2	1
9	SET/IN/BT/C409	Electrical Measurement and Instrumentation Lab	-	-	2	2	1
10	SET/EC /BT/S410	Mini Project I*	-	-	4	4	2
Total			15	5	12	32	21

*Skill Enhancement Course.

Semester V

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/IN/BT/C501	Control Systems	3	1	-	4	3
2	SET/EC/BT/C502	Digital Communication	3	1	-	4	3
3	SET/IN/BT/C503	Electrical Machines	3	1	-	4	3
4	SET/EC/BT/C504	VLSI Technology	3	1	-	4	3
5	SET/EC/BT/C505	Antenna and Wave Propagation	3	1	-	4	3
6	SET/IN/BT/C506	Control Systems Lab	-	-	2	2	1
7	SET/EC/BT/C507	Digital Communication and Antenna Lab	-	-	2	2	1
8	SET/IN/BT/C508	Electrical Machines Lab	-	-	2	2	1
9	SET/EC/BT/C509	VLSI Technology Lab	-	-	2	2	1
10	SET/EC/BT/S510	Mini Project II*		-	4	4	2
Total			15	5	12	32	21

*Skill Enhancement Course.

Semester VI

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C601	Digital Signal Processing	3	1	-	4	3
2	SET/EC/BT/C602	Microwave Engineering	3	1	-	4	3
3	SET/EC/BT/C603	Microcontrollers and Applications	3	1	-	4	3
4	SET/EC/BT/C604	Power Electronics	3	1	-	4	3
5	SET/EC/BT/C605	Computer System Architecture	3	1	-	4	3
6	SET/EC/BT/C606	DigitalSignal Processing Lab	-	-	2	2	1
7	SET/EC/BT/C607	Microwave Engineering Lab	-	-	2	2	1
8	SET/EC/BT/C608	Microcontrollers and Applications Lab	-	-	2	2	1
9	SET/EC/BT/C609	Seminar	-	-	2	2	1
10	SET/EC/BT/S610	Mini Project III*	-	-	4	4	2
Total			15	5	12	32	21

*Skill Enhancement Course.

Semester VII

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/SH/BT/C701	Principles of Management	3	1	-	4	3
2	SET/EC/BT/C702	VLSI Deign	3	1	-	4	3
3	SET/EC/BT/C703	Optical Fiber Communication	3	1	-	4	3
4		Elective I	3	1	-	4	3
5		Elective II	3	1	-	4	3
6	SET/EC/BT/C710	VLSI Deign Lab	-	-	2	2	1
7	SET/EC/BT/C711	Optical Fiber Communication Lab	-	-	2	2	1
8	SET/EC/BT/C712	Project Preparation	-	-	4	4	2
9	SET/EC/BT/S713	Industrial Training Seminar*	-	-	4	4	2
Total			15	5	12	32	21

*Skill Enhancement Course.

	S. No.	Code	Course Title
Elective I	1	SET/EC/BT/E704	Advance Semiconductor Devices
	2	SET/EC/BT/E705	Telecommunication Switching
	3	SET/EC/BT/E706	Digital Image Processing

	S. No.	Code	Course Title
Elective II	1	SET/EC/BT/E707	Data Communication and Networking
	2	SET/EC/BT/E708	FPGA Based Digital Design
	3	SET/EC/BT/E709	Information Theory and Coding

Semester VIII

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C801	Wireless and Mobile Communication	3	1	-	4	3
2	SET/EC/BT/C802	Embedded Systems	3	1	-	4	3
3		Elective III	3	1	-	4	3
4		Elective IV	3	1	-	4	3
5	SET/IN/BT/C809	Advanced Communication Lab	-	-	2	2	1
6	SET/IN/BT/C810	CAD Lab	-	-	2	2	1
7	SET/IN/BT/C811	Major Project	-	-	14	14	7
Total			12	4	18	34	21

	S. No.	Code	Course Title
Elective III	1	SET/EC/BT/E803	Radar Guidance And Navigation
	2	SET/EC/BT/E804	IC Fabrication And Testing
	3	SET/IN/BT/E805	Renewable Energy Engineering

	S. No.	Code	Course Title
Elective IV	1	SET/EC/BT/E806	Satellite Communication
	2	SET/EC/BT/E807	Multimedia Systems And Communication
	3	SET/EC/BT/E808	CMOS Analog IC Design

Note

(1) Topic for the Seminar in 6^{th} semesters shall be chosen by students in consultation with faculty. Topic shall not be mentioned in the syllabus anywhere, however, it should be related to Instrumentation Engineering.

(2) In 4^{th}, 5^{th} and 6^{th} semester, Mini Project work can be carried out individually or by a group of maximum of five students under the guidance of faculty. A committee of examiners will evaluate the projects.

(3) Students shall choose 2 elective subjects in 7^{th} and 8^{th} semester each from the given Table. An elective subject shall be offered only when at least 30% of the intake opts for that subject.
Major Project work shall be carried out during the 7^{th} and 8^{th} semester. Students can undertake Major Project individually or in group of not more than five students, under the guidance of a faculty or a group of faculty. Students have to present Synopsis of Major Project during the 7^{th} semester. Feasibility of the Project shall be assessed by the project evaluation committee of the department before the end of 7^{th} semester. However, Major Project would be evaluated in the end of 8^{th} semester.

Detailed Syllabi

SEMESTER I

S. No.	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE	SUB. TOTAL	Credits
1	SET/SH/BT/C101	Mathematics I	3	1	-	10	20	30	70	100	3
2	SET/SH/BT/C102	Physics	3	1	-	10	20	30	70	100	3
	SET/SH/BT/C203	Chemistry									
3	SET/EE/BT/C103	Basic Electrical Engineering	3	1	-	10	20	30	70	100	3
	SET/ME/BT/C202	Basic Mechanical Engineering									
4	SET/EC/BT/C104	Basic Electronics	3	1	-	10	20	30	70	100	3
	SET/ME/BT/C204	Engineering Mechanics									
5	SET/IT/BT/C105	Fundamentals of Information Technology	3	1	-	10	20	30	70	100	3
	SET/CS/BT/C205	Computer Programming									
6	AECC106	*Environmental Science	2	-	-	10	20	30	70	100	2
7	SET/SH/BT/C106	Physics Lab	-	-	2	30	-	30	70	100	1
	SET/SH/BT/C207	Chemistry Lab									
8	SET/EE/BT/C107	Basic Electrical Engineering Lab	-	-	2	30	-	30	70	100	1
	SET/ME/BT/C206	Basic Mechanical Engineering Lab									
9	SET/IT/BT/C108	Information Technology Lab	-	-	2	30	-	30	70	100	1
	SET/CS/BT/C208	Computer Programming Lab									
10	SET/ME/BT/S109	**Engineering Graphics			4	30	-	30	70	100	2
Total			16	5	10	180	120	300	700	1000	22

* Ability Enhancement Compulsory course.
**Skill Enhancement Course.

L - Lecture hours, T - Tutorialhours, P - Practicalhours, T.A - Teacher's Assessment, C.T - Class Test, TOT - Total, ESE - End Semester Examination.

SET/SH/BT/C101. MATHEMATICS I		
Module Name	**Content**	**No. of Hrs.**
Vector Calculus	Interpretation of Vectors & Scalars, Gradient, Divergence and Curl of a Vector and Their Physical Interpretation, Gauss Divergence Theorem and Stoke's Theorem.	8
Matrices	Elementary Row and Column Transformation, Linear Dependence, Rank of Matrix, Consistency of System of Linear Equation and Solution of Linear System of Equations. Characteristic Equation, Cayley-Hamilton Theorem, Eigen Values and Eigen Vectors, Diagonalization, Complex Matrices.	13
Differential Calculus	Libnitz theorem, Partial Differentiation, Eulerôs Theorem, Asymptotes, Curve Tracing, Envelops and Evolutes. Change of Variables, Jacobians, Expansion of Functions of One and Several Variables. Cylindrical and Spherical Coordinate System. Approximation of Errors. Extrema of Function of Several Variables, Langrangeôs Method.	13
Probability and Statistics	Binomial Distribution, Normal Distribution and Poissonôs Distribution. Correlation and Regression.	8
	Total No. of Hours	**42**
Textbooks	1. B. S. Grewal, ñHigher Engineering Mathematicsò, Khanna Publishers. 2. H K Das, ñAdvanced Engineering Mathematicsò, S Chand. 3. Erwin Kreyszig, ñAdvanced Engineering Mathematicsò.	
References	1. Shanti Narayan, ñA Text Book of Matricesò, S. Chand . 2. Finney Thomas, ñCalculus and Analytical Geometryò, Narosa Publication House. 3. N. Piskunov, ñDifferential and Integral Calculusò.	

SET/SH/BT/C102. PHYSICS		
Module Name	**Content**	**No. of Hrs.**
Optics	Interference: Coherent Sources, Conditions of Interference, Fresnelôs Biprism Experiment, Interference in Thin Films, Newtonôs Rings; Single and n-Slit Diffraction, Diffraction Grating, Raleighôs Criterion of Resolution, Resolving Power of Telescope, microscope;Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation.	13
Lasers and X-Rays	Laser: Principle of Laser Action, Einsteinôs Coefficients, Construction and Working of He-Ne and Ruby Laser; Introduction to Maser. Diffraction of X-Rays, Braggôs Law, Practical Applications of X-Rays, Compton Effect.	7
Basics Material Science	Introduction to crystal structure of materials, Miller indices for crystallographic planes and directions. X-ray diffraction for determination of crystal structure. Defects in solids: point, line and planar defects and their effect on properties of materials. Band theory of solids, conductors, semi-conductors and insulators, metals. Fermi Level. Magnetism: dipole moments, paramagnetism, Curieôs law, magnetization and hysterisis, Ferromagnetism and Anti-Ferromagnetism.Ferro electricity and Piezoelectricity. Superconductivity in materials.	14
Electromagnetics	Ampereôs Law and Displacement Current, Maxwellôs Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem.	8
	Total No. of Hours	**42**

Textbooks	1. Gaur, Gupta, ñEngineering Physicsò 2. Callister W.D., ñMaterials Science and Engineering: An introductionò, 6th Edition, John Wiley & Sons Inc., New York 2002
References	1. J. R. Taylor, C.D. Zafiratos and M. A. Dubson, Modern Physics for Scientists and Engineers, , 2nd Ed.,Pearson (2007) 2. Arthur Beiser, Concepts of Modern Physics, 6th Ed., TMH, (2009) 3. A.K. Ghatak : Optics 4. Subramanyam, Brijlal : Optics 5. WehrRichords&Adiav : Physics of Atoms 6. O.Svelto : Lasers 7. D.J. Griffith : Electrodynamics 8. Robert Eisberg and Robert Resnick, Quantum Physics of atoms, Molecules, Solids, Nuclei and Particle, 2nd Ed., John Wiley(2006) 9. Raghavan V. ñ Materials Science and Engineering ï A first courseò 5th Edition, Prentice Hall, New Delhi, 1998 10. Van Vlack, LH, ñ Elements of Materials Science and Engineeringò. 6th Edition, Addison ï Wesley Singapore, 1989 11. B. G. Streetman, Solid state Devices, 5th Ed., Pearson (2006) 12. Dekker, ñElectrical Engineering Materialsò, PHI

SET/EE/BT/C103. BASIC ELECTRICAL ENGINEERING		
Module Name	**Content**	**No. of Hrs.**
DC Networks	Concepts of linear, nonlinear, active, passive, unilateral and bilateral elements; Ideal and practical voltage & current sources ï conversion from one from the other; Kirchhoffôs laws ï statements; Mesh Analysis; Nodal Analysis; Delta-Star & Star-Delta conversion; Superposition principle; Theveninôs theorem ï statement, advantages in case of complex networks; explanation & illustration with examples; Nortonôs theorem, Maximum power transfer theorem, Reciprocity Theorem and its application.	10
Single Phase AC Circuits	Generation of single phase a.c. voltage and determination of average (mean) and RMS (effective) values of voltage and current with special reference to sinusoidal waveforms; Form factor and peak factor for various waves; Representation of sinusoidal time varying quantities as phasors; concepts of reactance, impedance and their representation in complex forms using j operator; Steady state analysis of series R-L-C circuit & its phasor diagram; Concept of power & power factor; Concept of admittance, susceptance in parallel circuits; Analysis of series parallel circuits &phasor diagrams; Resonance in series and parallel circuits.	10
Three Phase Circuits	Generation of 3-phase balanced sinusoidal voltage; star & delta connections; line & phase quantities (current & voltage); Solution of 3-phase star/delta circuits with balanced supply voltage and balanced load; phasor diagram; 3-phase, 4-wire circuits; Measurement of three phase power by two wattmeter method; phasor diagram with balanced load and determination of load power factor from wattmeter readings.	6
Transformers and Rotating Machines	Transformers: Constructional features and principle of operation, concept of ideal transformer under no load & loaded conditions and its equivalent circuit; Practical transformer rating & its equivalent circuit; Autotransformer ï principle of operation & relative advantages & disadvantages; Rotating Machine: construction features (stator, rotor & air gap), conditions for production of steady electromagnetic torque; Three phase Induction motor: constructional features and operation; DC Machines: construction features, EMF and Torque expression, Classification of D.C. motors and generators; Stepper motor.	12
Measuring Instruments	DC PMMC instruments ï constructional feature and principle of operation; Moving iron meters ï construction and principle of operation; Dynamometer type wattmeter; Induction type energy meter construction & principle of operation.	6
	Total No. of Hours	**44**
Textbooks	1. I.J. Nagrath, ñBasic Electrical Engineering,ò Tata Mc. Graw Hill.	
References	1. A. E. Fitgerald, D.E., Higginbotham and AGrabel, ñBasic Electrical Engineeringò, McGraw Hill. 2. Rizzoni, Principles and Applications of Electrical Engineering, TMH. 3. V. Del Toro. ñPrinciples of electrical Engineering, ñPrentice hall. 4. W.H. Hayt& J.E. Kemmerly,ò Engineering circuit Analysis, ñMcGraw Hill. 5. H. Cotton, ñAdvanced Electrical Technologyò Wheeler Publishing.	

SET/EC/BT/C104. BASIC ELECTRONICS		
Module Name	**Content**	**No. of Hrs.**
Semiconductor Diodes	Semiconductor materials- intrinsic and extrinsic types, Ideal Diode as switch, Terminal characteristics of PN diode - p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region; Zener diode and applications e.g. voltage regulator; Rectifier Circuits, Clipping and Clamping circuits; LED, Photo Diode.	10
Bipolar Junction Transistors	Physical structure, physical operation and current-voltage characteristics of NPN transistor; Use of Voltage dependent Current source as an Voltage amplifier; Transistor as an amplifier: Characteristics of CE amplifier; Active region operation of transistor; D.C. analysis of Common Emitter Amplifier: load line analysis; Transistor as a switch: cut-off and saturation modes.	10
Field Effect Transistor	Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics; MOSFET as a Switch, MOSFET as a Voltage dependent Current source and Amplifier.	8
Operation Amplifier	Ideal Op-amp; Properties of the ideal Operational Amplifier; op-amp application circuits (assuming ideal op amp): inverting amplifier, non -inverting amplifier, weighted summer, integrator, and differentiator.	6
Digital Logic and Gates	Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Basic logic operations and logic gates; MOSFET Switch Implementation of Logic Gates e.g. Inverter, NAND, NOR. Basic postulates and fundamental theorems of Boolean algebra.	8
	Total No. of Hours	**42**
Textbooks	1. Agarwal, Anant; Lang, Jeffrey H, ñFoundations of Analog and Digital Electronic Circuitsò, Elsevier Science & Technology Books.	
References	1. V. Del Toro, Principles of Electrical Engineering, PHI. 2. Rizzoni, Principles and Applications of Electrical Engineering, TMH. 3. Malvino, Electronic Principles. 4. R.L.Boylestad&L.Nashelsky, Electronics Devices & Circuit Theory, PHI.	

SET/IT/BT/C105. FUNDAMENTALS OF INFORMATION TECHNOLOGY		
Module Name	**Content**	**No. of Hrs.**
Introduction	Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers, Computer Hardware and Basic Computer Organization: CPU- ALU, CU; RAM/ROM, Various I/O devices, Peripherals, Storage Media.	4
Computer Languages	Binary, Hexadecimal Number System; Basic Binary Logic Operations; Binary Addition and Subtraction; Generation of Languages, Assembly Language, High level language; Translators, Interpreters, Compilers, Compilers; Flow Charts, Dataflow Diagram, Pseudo codes; Assemblers, Introduction to 4GLs.	6
OS & Office	Software- System and Application Software; Elementary Concepts in Operating System; Textual Vs GUI Interface, Introduction to DOS, MS Windows.	4
Computer Networks	Elements of Communication system; Brief Introduction to Computer Networks- Introduction of LAN and WAN. Network Topologies, Client-server Architecture.	6
Internet	Internet & World Wide Web, Hypertext Markup Language, DHTML, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email; Introduction to Web Development, Static and Dynamic Pages.	6
IT Application and Multi media	Basic Awareness of NICNET and ERNET; E Commerce, E governance; Brief Introduction to Different Formats of Image, Audio, Video.	6
Information Concepts & Processing	Definitions of Information , Need of information, quality of information, value of information, concept of information, Entropy category and Level of information in Business Organization, Data Concepts and Data Processing, Data Representation, Application of IT to E-commerce, Electronic Governance, Multimedia, Entertainment, Introduction to Information System.	8
	Total No. of Hours	**40**
Textbooks	1. Sinha, Sinha, ñComputer Fundamentalsò. 2. Yadav R. P., ñInformation Technologyò.	
References	1. D S Yadav, ñFoundations of ITò, New Age, Delhi. 2. Rajaraman, ñIntroduction to Computersò, PHI. 3. Peter Nortans ñIntroduction to Computersò, TMH. 4. Patterson D.A. & Hennessy J.L., "Computer Organization and Design", Morgan Kaufmann Publishers.	

AECC106. ENVIRONMENT SCIENCE		
Module Name	**Content**	**No. of Hrs.**
Introduction to Environmental Sciences	Multidisciplinary nature of Environmental Sciences; Scope and importance; Concept of sustainability and sustainable development.	2
Ecosystems	What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Case studies of the following ecosystems : a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	6
Natural Resources: Renewable and Non-renewable Resources	Land resources and land use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations. Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state). Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs, case studies.	8
Biodiversity and Conservation	Levels of biological diversity : genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots India as a mega-biodiversity nation; Endangered and endemic species of India Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.	8
Environmental Pollution	Environmental pollution : types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks Solid waste management: Control measures of urban and industrial waste. Pollution case studies.	8
Environmental Policies & Practices	Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture Environment Laws: Environment Protection Act 1986; Air (Prevention & Control of Pollution) Act 1981; Water (Prevention and control of Pollution) Act 1974; Wildlife Protection Act 1972; Forest Conservation Act 1980. International agreements: Montreal protocol, Kyoto protocol and Convention on Biological Diversity (CBD). Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.	7
Human Communities and the Environment	Human population growth: Impacts on environment, human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods, earthquake, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation. Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).	6

Field work	Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, lake, forest patch, grassland, Delhi Ridge, etc.	5
	Total No. of Hours	**50**

Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from Indiaôs Himalaya dams. *Science,* 339: 36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, H.T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
11. Rao, M.N. & Datta, A.K. 1987. *Waste Water Treatment*. Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. *Environment*. 8th edition. John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M. L. 2001. *Environmental law and policy in India. Tripathi 1992*.
14. Sengupta, R. 2003. *Ecology and economics*: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. *Ecology, Environmental Science and Conservation*. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. *Conservation Biology*: *Voices from the Tropics*. John Wiley & Sons.
17. Thapar, V. 1998. *Land of the Tiger*: *A Natural History of the Indian Subcontinent*.
18. Warren, C. E. 1971. *Biology and Water Pollution Control*. WB Saunders.
19. Wilson, E. O. 2006. *The Creation: An appeal to save life on earth*. New York: Norton.
20. World Commission on Environment and Development. 1987. *Our Common Future*. Oxford University press

SET/SH/BT/C106. PHYSICS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. To determine the wavelength of monochromatic light by Newtonôs ring method. 2. To determine the wavelength of monochromatic light by Fresnelôs biprism. 3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points. 4. To determine the wavelength of spectral lines using plane transmission grating.	6x2
Module 2	1. Measurement of Magnetic susceptibility- Quinckeôs Method / Gouyôs balance. 2. Mapping of magnetic field.	2x2
Module 3	1. Measurement of e/m of electron ï Thomsonôs experiment. 2. Determination of Planckôs constant.	2x2
Module 4	1. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility. 2. To study the Hall Effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material. 3. To determine the energy band gap of a given semiconductor material.	4x2
	Total No. of Hours	**28**

SET/EE/BT/C107. BASIC ELECTRICAL ENGINEERING LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Study of analog voltmeter and ammeter. 2. Study of digital multimeter. 3. Study of CRO.	3x2
Module 2	1. Verification of KCL and KVL. 2. Verification of Thevenin, Norton Network theorems. 3. Verification of Superposition Network theorem. 4. Verification of MPT Network theorem.	3x2
Module 3	1. Measurement of efficiency of a single phase transformer by load test. 2. Determination of parameters and losses in single phase transformer by OC and SC test. 3. Measurement of power in a three phase circuit by two wattmeter method. 4. Verification of Single Phase Energy Meter constant. 5. Study of thee phase induction motor.	5x2
Module 4	1. Verification of junction diode, zener diode characteristics. 2. Verification of Clipping and clamping circuits. 3. Verification of H.W. and F.W. rectifier circuit: with and without filter circuit and to determine the ripple factor. 4. Verification of CE characteristics of BJT.	4x2
	Total No. of Hours	**30**

SET/IT/BT/C108. INFORMATION TECHNOLOGY LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Creation of a Word Document. 2. Creation of a Document in spredsheet and using Formulae. 3. Use of Search Engine and World Wide Web. 4. Creation of email id and email. 5. Use of FTP service. 6. Creation of Static Web Pages using HTML. 7. Creation of Page Using Java Script. (Besides these additional experiments can be included to give hands on experience to students. Students can be provided opportunity to work on any Information System to give them better understanding of Information System)	14x2
	Total No. of Hours	**28**

SET/ME/BT/S109. ENGINEERING GRAPHICS		
Module Name	**Content**	**No. of Hrs.**
Introduction to Engineering Graphics	Drawing instruments and their use ï Different types of lines - Lettering & dimensioning ï Familiarization with current Indian Standard Code of Practice for Engineering Drawing. Scales, Plain scales, Diagonal scales, Vernier scales. Introduction to orthographic projections- Horizontal, vertical and profile planes ï First angle and third angle projections ï Projection of points in different coordinates ï Projections of lines inclined to one of the reference planes.	12
Projections of lines and planes	Projections of lines inclined to both the planes ï True lengths of the lines and their angles of inclination with the reference planes ï Traces of lines. Projection of plane lamina of geometric shapes inclined to one of the reference planes ï inclined to both the planes, Traces of planes. Projections on auxiliary planes.	12
Projections of polyhedral and solids	Projections of polyhedral and solids of revolution, projection of solids with axis parallel to one of the planes and parallel or perpendicular to the other plane ï Projections with the axis inclined to one of the planes. Projections of Solids with axis inclined to both the planes ï Projections of spheres and combination of solids.	12
Sections of solids	Sections of solids by planes perpendicular to at least one of the reference planes ï True shapes of sections. Developments, development of the lateral surface of regular solids like, prisms, pyramids, cylinders, cones and spheres, development of truncated solids Isometric projection ï Isometric scale ï Isometric views ï Isometric projection of prisms, pyramids, cylinders, cones, spheres and solids made by combination of the above.	12
	Total No. of Hours	**48**
Textbooks	1. Bhatt N. D, Elementary Engineering Drawing, Charotar Publishing House, Anand, 2002.	
References	1. Narayana K L &Kannaiah P, Engineering Graphics, Tata McGraw Hill, New Delhi, 1992. 2. Luzadder W J, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2001. 3. Thomas E French &Charkes J V, Engineering Drawing & Graphing Technology, McGraw Hill Book Co, New York 1993. 4. Venugopal K, Engineering Drawing & Graphics, New Age International Pvt. Ltd., New Delhi, 1994.	

SEMESTER II

S. No.	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/SH/BT/C201	Mathematics II	3	1	-	10	20	30	70	100	3
2	SET/ME/BT/C202	Basic Mechanical Engineering	3	1	-	10	20	30	70	100	3
	SET/EE/BT/C103	Basic Electrical Engineering									
3	SET/SH/BT/C203	Chemistry	3	1	-	10	20	30	70	100	3
	SET/SH/BT/C102	Physics									
4	SET/ME/BT/C204	Engineering Mechanics	3	1	-	10	20	30	70	100	3
	SET/EC/BT/C104	Basic Electronics									
5	SET/CS/BT/C205	Computer Programming	3	1	-	10	20	30	70	100	3
	SET/IT/BT/C105	Fundamentals of Information Technology									
6	AECC206	*General English	2	-	-	10	20	30	70	100	2
7	SET/ME/BT/C206	Basic Mechanical Engineering Lab	-	-	2	30	-	30	70	100	1
	SET/EE/BT/C107	Basic Electrical EngineeringLab									
8	SET/SH/BT/C207	Chemistry Lab	-	-	2	30	-	30	70	100	1
	SET/SH/BT/C106	Physics Lab									
9	SET/CS/BT/C208	Computer Programming Lab	-	-	2	30	-	30	70	100	1
	SET/IT/BT/C108	Information Technology Lab									
10	SET/ME/BT/S209	**Engineering Workshop	-	-	4	30	-	30	70	100	2
Total			16	5	10	180	120	300	700	1000	22

* Ability Enhancement Compulsory course.
**Skill Enhancement Course.

L ï Lecture hours, T ï Tutorialhours, P ï Practicalhours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination.

SET/SH/BT/C201. MATHEMATICS II		
Module Name	**Content**	**No. of Hrs.**
Multiple Integral	Double and triple integrals, change of order of integration. Change of variables, application to area, volume, centre of gravity, moment of inertia and product of inertia. Gamma and Beta functions, Drichletôs integral and its application.	9
Fourier Series	Periodic functions, Fourier series of functions with period 2n, change of interval, half range sine and cosine series.	6
Integral Transform	Laplace transforms, existence theorem, Laplace transform derivatives, inverse Laplace transform, application to solve linear differential equations, unit step function, Dirac delta function, Laplace transforms of periodic functions. Application of Laplace transforms. Definitions of Fourier and Z-transform and its simple applications.	12
Ordinary Differential Equations	Introduction to order, degree and arbitrary constants, linear differential equations of nò order with constant coefficient, complimentary functions and particular integrals. Homogeneous differential equations, simultaneous linear differential equations. Solutions of second order differential equations by changing dependent and independent variables. Method of variation of parameters, equations of the form yò = f(y), applications to engineering problems.	12
Solutions of Equations and Curve Fitting	Solutions of cubic and bi-quadric equations. Method of least square and curve fitting.	6
	Total No. of Hours	**45**
Textbooks	1. B. S. Grewal, ñHigher Engineering Mathematicsò, Khanna Publishers. 2. H K Das, ñAdvanced Engineering Mathematicsò, S Chand. 3. Erwin Kreyszig, ñAdvanced Engineering Mathematicsò.	
References	1. J. N. Kapoor, ñA Text Book of Differential Equationsò.	

SET/ME/BT/C202. BASIC MECHANICAL ENGINEERING		
Module Name	**Content**	**No. of Hrs.**
Laws of Thermodynamics	Concept of temperature, equality of temperature, Zeroth law, principles of thermometry and temperature scale. First law of thermodynamics, concept of internal energy, application of first law to a closed system to various processes, flow processes and control volume, flow work, steady flow energy equation, mechanical work in steady flow process, throttling process, application of first law to open system. Essence of second law, thermal reservoir, heat engines and thermal efficiency. COP of heat pump and refrigerator, definition of available and unavailable energy. Statement of second law, Carnot cycle, Carnot's theorem, Clausius inequality, concept of entropy, entropy changes for ideal gases.	8
Properties of Steam	Generation of steam at constant pressure, various states of water, steam, properties of steam, use of property diagram, processes of vapour in closed and open system, determination of dryness fraction of steam by separating and throttling calorimeter, Rankine cycle.	5
Thermodynamic Cycle	Definitions of bore, stroke, clearance ratio, compression ratio, definition and calculation of mean effective pressure from the cyclic work (proof not required), indicated pressure, air standard cycle (Otto and diesel cycle), principle of working and description of two and four stroke S.I. and C.I. engine.	8
Strength of Material- Simple Stresses and Strains	Stress- tensile and compressive, strain, strain energy, stress-strain diagram, ductile and brittle material, elastic constants, impact loading, varying cross-section and load, temperature stresses, shear stress, complementary shear stress, shear strain.	8
Compound Stresses and Strains	State of stress at a point, oblique stress, simple tension, pure shear, general two dimensional stress system, principal planes, principal stresses and strains, Mohrôs stress circle, Poissonôs ratio, maximum shear stress.	8
Bending Stress and Torsion	Pure bending, moment of inertia, section modulus, bending stresses, combined bending and direct stress, beam of uniform strength, middle third and middle quarter rules for rectangular and circular sections, Circular shafts, torsional shear stress, strain energy in torsion, shafts under varying torque, compound shafts, combined bending and twisting.	8
	Total No. of Hours	**45**
Textbooks	1. R S Khurmi, ñEngineering Mechanicsò. 2. P K Nag ñEngineering Thermodynamicsò.	
References	1. Van Wylen G.J. &Sonnlog R.E.: Fundamentals of classical thermodynamics, John Wiley &Sons,Inc. NY. 2. WarkWenneth : Thermodynamics (2nd edition), McGraw Hill book Co. NY. 3. Holman, J.P.: Thermodynamics, MC Graw Hill book Co. NY. 4. Yadav R.: Thermodynamics and Heat Engines, Vol I & II (Sl Edition) Central Publishing House Allahabad. 5. Yadav R.: Steam & Gas Turbines. 6. Kshitish Chandra Pal: Heat Power, Orient Longman Limited, 17, Chittranjan Avenue, Calcutta. 7. S. Rao, B.B. Parulekar, óEnergy Technologyô, Khanna Pub., New Delhi. 8. G. H. Ryder: "Strength of Materials". 9. F. L. Singer: "Strength of Materials". 10. Timoshenko: "Strength of Materials". 11. Beer, Johnson, Staticsò.	

SET/SH/BT/C203. CHEMISTRY		
Module Name	**Content**	**No. of Hrs.**
Thermodynamics	Terminology in Thermodynamics, Zeroth law of Thermodynamics, First law of Thermodynamics, Enthalpy, Reversible isothermal expansion of ideal gas, Adiabatic expansion of ideal gas, Joule-Thomson effect.	4
Lubricants	Theory, classification and mechanism of lubrication.	4
Polymers	Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibres, polymethylmethacrylate, poly acrylonitrile and polystyrene. A brief account of conducting polymers (polypyrrole&polythiophene) & their applications.	3
Complex Compounds	Introduction, Valence bond and crystal field theory for bonding in complexes.	4
Chemical Kinetics & Catalysis	Order and molecularity of reactions, Catalysis- homogeneous and heterogeneous catalysis. Characteristics of catalytic reactions, catalytic promoters and poisons, auto catalysis and negative catalysis. Activation energy of catalysis, intermediate compound formation theory and adsorption theory.	3
Atmospheric Chemistry& Air Pollution	Environment and ecology, environmental segments, structure and composition of atmosphere, radiation balance of earth and Green House Effect, formation and depletion of Ozone layer, chemical and photochemical reactions of various species in atmosphere, air pollution- sources, reactions and sinks for pollutants, acid rains and smog formation. Pollution control methods.	5
Corrosion	Introduction, causes of corrosion, theories of corrosion- direct chemical attack, electrochemical theory of corrosion, factors influencing corrosion, passivity, types of corrosions, protection from corrosion (Cathodic and anodic protection) and protective metallic coatings (Galvanizing and tinning).	5
Water and Waste Water Chemistry	Introduction, Hardness of Water, Characteristics Imparted by Impurities, Determination of hardness by EDTA method, Treatment of Water by Zeolite, L-S Process, Boiler problems caused by use of hard Water, Reverse osmosis process for purification of water. Numerical based on hardness of water, zeolite process and Lime-soda process.	6
Fuels & Combustion	Classification of Fuels, Non-Conventional Energy, Biogas, and Solar Energy, Calorific value ï Gross and Net, Characteristics of Good Fuel, Determination of Calorific Value by bomb calorimeter method (theory and numerical), Solid Fuels: Analysis of Coal (Proximate and ultimate analysis of coal theory and numerical), Liquid Fuels: mining and refining of petroleum, cracking (Thermal and catalytic), Knocking, octane and cetane number .	5
Stereochemistry of Organic-Compounds	Mechanism of Chemical Reaction, Beckman, Hoffman, Reimer Tiemann, Cunnizzaro, Diels- Alder and Skraup synthesis.	3
	Total No. of Hours	**42**

Textbooks	1. Jain, Jain, ñEngineering Chemistryò. 2. Sharma, Kumar, ñEngineering Chemistryò.
References	1. R. T. Morrison and R N Boyd, ñOrganic Chemistryò, 6th Edition, Prentice Hall, New Delhi. 2. J. D. Lee, ñConcise Inorganic Chemistryò, Chapman & Hall. 3. W. L. Jolly, ñModern Inorganic Chemistryò, McGraw-Hill. 4. P.W. Atkins, ñPhysical Chemistryò, 6th Edition, Oxford University Press. 5. Barrow, ñPhysical Chemistryò. 6. Manahan, ñEnvironmental Chemistryò. 7. D. L. Pavia, GM. Lampman, GS. Kriz and J.R Vyvyan, I, ñSpectroscopyò, Cengage Learning India Pvt. Ltd, New Delhi, 2007. 8. R.M. Silverstein, F.X. Webster and D.J. Kiemle, ñSpectrometric Identification of Organic Compoundsò, 7th edition, John-Wiley and Sons, New York, 2005. 9. William Kemp, ñOrganic Spectroscopyò, 3rd edition, Palgrave, New York, 2005. 10. C.N. Banwell and E. M. McCash, ñFundamentals of Molecular Spectroscopyò, McGraw- Hill, International, UK, 1995. 11. F. Carey, ñOrganic Chemistryò, 5th Edition, McGraw Hill Publishers, Boston, 2003.

SET/ME/BT/C204. ENGINEERING MECHANICS		
Module Name	**Content**	**No. of Hrs.**
Force System	Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnonôs theorem, Lamiôs theorem, equilibrium of bodies under a force system, Problems.	10
Trusses And Frames	Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems.	10
Centre Of Gravity And Moment Of Inertia	Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems, Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.	13
Kinematics And Dynamics	Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems. Particle Dynamics: Energy methods and momentum methods, Newtonôs laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.	12
	Total No. of Hours	**45**
Textbooks	1. R S Khurmi, ñEngineering Mechanicsò. 2. P K Nag ñEngineering Thermodynamicsò.	
References	1. Van Wylen G.J. &Sonnlog R.E.: Fundamentals of classical thermodynamics, John Wiley &Sons,Inc. NY. 2. Wark Kenneth: Thermodynamics (2nd edition), McGraw Hill book Co. NY. 3. Holman, J.P.: Thermodynamics, MC Graw Hill book Co. NY. 4. Yadav R.: Thermodynamics and Heat Engines, Vol I & II (Sl Edition) Central Publishing House Allahabad. 5. Yadav R.: Steam & Gas Turbines. 6. Kshitish Chandra Pal: Heat Power, Orient Longman Limited, 17, Chittranjan Avenue, Calcutta. 7. S. Rao, B.B. Parulekar, óEnergy Technologyô, Khanna Pub., New Delhi. 8. G. H. Ryder: "Strength of Materials". 9. F. L. Singer: "Strength of Materials". 10. Timoshenko: "Strength of Materials". 11. Beer, Johnson, Statics.	

SET/CS/BT/C205. COMPUTER PROGRAMMING		
Module Name	**Content**	**No. of Hrs.**
Introduction	C Character Set, Identifiers and Keywords, Data Types, Declarations, Expressions, Statements and Symbolic Constants.	6
Operators and Expressions	Arithmetic, Unary, Relational, Logical, and Assignment Operators, Conditional Operator, Library Functions.	6
Control Statements	While, Do-while, For Statements, Nested Loops, If-Else, Switch, Break, Continue and Go to Statements, Comma Operator.	5
Functions	Defining and Accessing Functions, Function Prototypes, Passing Arguments, Recursion, and Use of Library Functions.	5
Program Structure	Storage classes, Automatic, External, Static Variables.	4
Arrays	Defining and Processing, Passing to a Function, Multidimensional Arrays, Arrays and Strings.	4
Pointers	Declarations, Passing to a Function, Operations on Pointers, Pointers and Arrays, Dynamic Memory Allocation, Array of Pointers.	6
Structures and Unions	Basics of Structures, Structures and Functions, Arrays of Structures, Pointers to Structures, Self Referential Structures, type definitions, Unions.	4
Data Files	Open, Close, Create, Process, Unformatted data files.	4
	Total No. of Hours	**44**
Textbooks	1. E. Balagurusamy, ñProgramming in ANSI Cò.	
References	1. Byron S. Gottfried, ñProgramming With Cò. 2. YashwantKanitker, ñLET US Cò. 3. B. W. Kernighan and D. M. Ritchie, ñThe C Programming Languageò. 4. B. W. Kernighan, ñThe Practice of Programmingò, Addison-Wesley, 1999. 5. C. L. Tondo and S. E. Gimpel, ñThe C Answer Bookò, (2/e), Prentice Hall, 1988.	

AECC206. GENERAL ENGLISH		
Module Name	**Content**	**No. of Hrs.**
Introduction:	Theory of Communication, Types and modes of Communication	-
Language of Communication	Verbal and Non-verbal (Spoken and Written) Personal, Social and Business Barriers and Strategies Intra-personal, Inter-personal and Group communication	-
Speaking Skills	Monologue Dialogue Group Discussion Effective Communication/ Mis-Communication Interview Public Speech	-
Reading and Understanding	Reading and Understanding Close Reading Comprehension Summary Paraphrasing Analysis and Interpretation Translation(from Indian language to English and vice-versa) Literary/Knowledge Texts	-
Writing Skills	Documenting Report Writing Making notes Letter writing	-
	Total No. of Hours	**-**

Textbooks

1. Fluency in English - Part II, Oxford University Press, 2006.
2. Business English, Pearson, 2008.
3. Language, Literature and Creativity, Orient Blackswan, 2013.
4. Language through Literature (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas

SET/ME/BT/C206. BASIC MECHANICAL ENGINEERING LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Study of boiler models ï Babcock Wilcox, Lancashire and Locomotive. 2. Study of Steam Engine and Steam Turbine models. 3. Study of 2-Stroke and 4-Stroke ICE models. 4. Study of vapour compression Refrigeration unit tutor. 5. Study of window type air conditioner. 6. To conduct the tensile test on a UTM and determine ultimate tensile strength, percentage elongation for a steel specimen. 7. To conduct the compression test and determine the ultimate compressive strength for a specimen. 8. To conduct impact test (Izod/Charpy) on the impact testing machine and find the impact strength.To determine the hardness of the given specimen using Brinell/Rockwell/Vicker testing machine.	15x2
	Total No. of Hours	**30**

SET/SH/BT/C207. CHEMISTRY LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. To determine Saponification value of given oil sample. 2. To determine the ferrous content in the supplied sample of iron ore by titrimetric analysis against standard $K_2Cr_2O_7$ solution using $K_3Fe(CN)_6$ as external indicator. 3. To determine the chloride content in supplied water sample using Mohrôs method. 4. To determine acid value of given oil sample. 5. To determine the total hardness of water sample by EDTA titration. 6. To find chemical oxygen demand of a waste water sample using Potassium Dichromate. 7. Estimation of iron in plain carbon steel by redox titration. 8. Estimation of copper in brass by titration method. 9. Estimation of Zinc in brass by titration method. 10. Analysis of a coal sample by proximate analysis method.	15x2
	Total No. of Hours	**30**

SET/CS/BT/C208. COMPUTER PROGRAMMING LAB		
Module	**Content**	**No. of Hrs.**
Module 1	This lab shall have minimum 25 programs in C. There shall be minimum two programs per module as taught in theory. Programming shall follow logic/algorithm and flowchart wherever applicable. Exercises shall also enhance analytical and debugging abilities.	14x2
	Total No. of Hours	**28**

SET/ME/BT/C209. ENGINEERING WORKSHOP		
Module	**Content**	**No. of Hrs.**
Module 1	Mechanical Engineering covering, the following trades for experiments (with a minimum of two exercises under each trade) - Carpentry, Fitting, Tin-Smithy and Development of jobs carried out and soldering, Black Smithy, House Wiring, Foundry (Molding only), Plumbing.	16X2
Module 2	Power tools in Construction, Wood working, Electrical and Mechanical Engineering practices.	8x2
	Total No. of Hours	**48**

SEMESTER III

S. No.	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/SH/BT/C301	Mathematics III	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C302	Electronic Devices and Circuits	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C303	Digital Electronics	3	1	-	10	20	30	70	100	3
4	SET/IN/BT/C304	Signals and Systems	3	1	-	10	20	30	70	100	3
5	SET/IN/BT/C305	Circuit Theory	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C306	Electronic Devices and Circuits Lab	-	-	2	30	-	30	70	100	1
7	SET/EC/BT/C307	Digital Electronics Lab	-	-	2	30	-	30	70	100	1
8	SET/IN/BT/C308	Signals and Networks Lab	-	-	4	30	-	30	70	100	2
9	SET/EC/BT/S309	Electronics Servicing Lab*	-	-	4	30	-	30	70	100	2
Total			15	5	15	170	100	270	630	900	21

*Skill Enhancement Course.

L ï Lecture hours, T ï Tutorial hours, P ï Practical hours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination

SET/SH/BT/C301. MATHEMATICS III		
Module Name	**Content**	**No. of Hrs.**
Ordinary Differential Equations	ODE of 2nd order with constant coefficients both homogeneous and non-homogeneous types with applications to electrical and mechanical systems. Difference equations and their solutions by Z transform. Series solutions of ODE of 2nd orders with variable coefficients with special emphasis to the differential equations of Legendre, Bessel and Chebyser. Legendreôs polynomials, Chabyshev polynomials and Besselôs functions and their properties.	14
Integral Transforms	Fourier transform and integral Hankel transforms and Hilbert transforms and their properties, some simple applications.	7
Partial Differential Equations	Linear PDE with constant coefficients of 2nd order and their classifications. PDE of parabolic, elliptic and hyperbolic type with illustrative examples. Separation of variables method for solving PDE, such as two dimensional heat equations, wave equations and Laplace equations.	10
Functions of a Complex Variable	Analytic functions, Cauchy Riemann equations, harmonic functions line integral in the complex plane, Cauchyôs integral theorem, Cauchyôs integral formula derivatives of analytic function, Liouvilles theorem, fundamental theorem of algebraic representation of a function by power series, Taylor's &Laurant series, poles & singularity of zeros. Residue theorem, conformal mapping, linear fractional transformation, special linear tranctional transformations.	14
	Total No. of Hours	**45**
Textbooks	1. B. S. Grewal, ñHigher Engineering Mathematicsò, Khanna Publishers. 2. H K Das, ñAdvanced Engineering Mathematicsò, S Chand. 3. Erwin Kreyszig, ñAdvanced Engineering Mathematicsò.	
References	1. Paopoulis, ñSignal Analysisò, TMH.	

SET/EC/BT/C302. ELECTRONIC DEVICES AND CIRCUITS		
Module Name	**Content**	**No. of Hrs.**
PN Junction	Carrier Statistics: Charge carriers in semiconductors, Fermi Dirac statistics, intrinsic and extrinsic semiconductors, carrier transport, mobility, conductivity, carrier life time, recombination, steady state carrier generation, quasi Fermi levels, drift and diffusion of carriers, continuity equation PN Junction: PN junction at equilibrium, Forward and reverse bias junctions, steady state conditions, forward and reverse bias, break down of junctions, Metal Semiconductor contacts: Rectifying and ohmic contacts, current voltage characteristics.	6
Diodes and Applications	Diode-large signal and small signal operation; Diode Circuits; Special Diodes: Zener Diode, Schottkey Diode, Photo Diode; Varactor Diode, Tunnel Diode; Light Emitting Diode.	5
BJT Amplifiers	BJT operation and characteristics: active mode, saturation mode; BJT Models: large signal model, transconductance, small signal model, early effect; Amplifier: input impedance, output impedance, gain; Operating point analysis and design: simple biasing, resistive divider biasing, biasing with emitter degeneration, self bias, and design procedures; Analysis and Design of different topologies: CE, CE with emitter degeneration, CB, CC (Emitter follower); Multi-stage amplifier; Bipolar Cascode amplifier, Bipolar current mirror; Bipolar differential amplifier.	10
MOSFET Amplifiers	MOSFET operation and characteristics: MOSFET as variable resistor, channel pinch off, derivation of I-V characteristics, triode and saturation region, transconductance; MOS device models: large signal model, small signal model, channel length modulation; comparison of Bipolar transistor and MOSFET; MOS Amplifier topologies: biasing, realizing current source, CS, CS with current source load, CS with diode connected load, CS with degeneration, CS with biasing, CG, CG with biasing, CD (source follower), CD with biasing; CMOS Cascode amplifier, MOS current mirror; MOS differential amplifier.	10
Frequency Response	Poles and zeroes in circuits, Bode plot, millerôs theorem, high frequency models for BJT and MOSFET; transit or cut-off frequency of device; frequency response of CE and CS amplifier; bandwidth, effect of frequency on I/O impedances.	5
Feedback	Negative feedback: gain desensitization, bandwidth extension, modification of I/O impedances, linearity improvement; types of amplifiers: voltage, trans-impedance, trans-conductance, and current amplifiers; Sense and return techniques; polarity of feedback; feedback topologies: voltage-voltage feedback, voltage-current feedback, current-voltage feedback, current-current feedback; Stability in feedback systems: problem of instability, stability condition, Nyquist stability criterion, phase margin, frequency compensation; Barkhousen condition for Oscillations, Sinusoidal oscillators.	5
Power Amplifiers	Distortion and efficiency; emitter follower as power amplifier; push-pull stage, high fidelity design using feedback; heat dissipation, thermal runaway; efficiency of emitter follower and push-pull stage; power amplifier classes; transformer coupled amplifiers.	4
	Total No. of Hours	**45**
Textbooks	1. BehzadRazavi, ñFundamental of Microelectronic Circuitsò, Wiley. 2. R.L.Boylestad, L.Nashelsky, ñElectronics Devices & Circuit Theoryò PHI. 3. B. G. Streetman, ñSolid state Devicesò, Pearson.	
References	1. Millman, Halkias, ñElectronic Devices and Circuitsò. 2. David A. Bell, ñElectronic Devices and Circuitsò. 3. Sedra, Smith, ñMicroelectronic Circuitsò.	

SET/EC/BT/C303. DIGITAL ELECTRONICS		
Module Name	**Content**	**No. of Hrs.**
Introduction	Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers. Definition and specification of combination logic; Truth table; Basic logic operation and logic gates; Binary coded decimal codes; Gray codes.	6
Boolean Algebra and Switching Functions	Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map.	4
Logic Families	Diode, BJT and MOSFET as a switch. Introduction to different logic families; Electrical characteristics of logic gates ï logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product; circuit description and operation; RTL; DTL,HTL,TTL and sub families , Brief idea of ECL, CMOS BI-CMOS.	10
Combinational Logic	Arithmetic modules: adders, subtractors and ALU; Design examples. Decoders, encoders, multiplexers and de-multiplexers; Parity circuits and comparators.	6
Sequential Logic	Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop and their inter-conversions; Timing hazards and races; Meta-stability; Analysis of state machines using D flip-flops and JK flip-flops; Definition of state machines, synchronous sequential logic, shift register, counters-ripple and mod counters.	12
Semiconductor Memories	RAM, ROM, Content Addressable Memory, Charge Coupled Device Memory. PLAs, PALs and their applications; Sequential PLDs and their applications.	4
	Total No. of Hours	**42**
Textbooks	1. Morris Mano, ñDigital Designò.	
References	1. Taub, Schilieng, ñDigital Integrated Electronicsò. 2. Anad Kumar, ñDigital principles and applicationò. 3. John F Wakerly, ñDigital Design: Principles and Practicesò, Prentice Hall. 4. Thomas L. Floyd, ñDigital Fundamentalsò, Pearson/ Prentice Hall. 5. Ronald J. Tocci, ñDigital Systems: Principles and Applicationsò, Pearson/ Prentice Hall. 6. Charles Roth, ñFundamentals of Logic Designò, Jaico Publishing House.	

SET/IN/BT/C304. SIGNALS AND SYSTEMS		
Module Name	**Content**	**No. of Hrs.**
Introduction to signals	Classification of signals, basic continuous- time and discrete- time signals, step and impulse functions, transformation of independent variable. Sampling, Quantization, Encoding; Sampling theorem.	6
Introduction to systems	Properties of systems, classification of systems, mathematical model for systems, normal form of system equations, initial conditions; Impulse response of a physical system, Introduction to convolution, Convolution integral, numerical convolution. , auto correlation function, properties of auto correlation function, cross correlation functions, properties of cross correlation functions.	8
Fourier Analysis	Representation of signals in terms of elementary signals, condition for orthogonality, representation of signals by elementary sinusoids, Fourier series representation, power spectrum, Fourier Transform, system function, energy spectrum, Calculation of simple transforms, Discrete Fourier Transform (DFT), properties of Discrete Fourier Transform.	12
Laplace Transform	Convergence of laplace transform, Properties of laplace transform, inversion of laplace transform, solution of differential equation, bilateral laplace transform.	8
Z-transform	Z-transform, convergence of Z-transform, properties of Z-transform, inversion of Z-transform, evaluation of system frequency response, applications of Z-transform.	8
	Total No. of Hours	**42**
Textbooks	1. Simon Haykin, ñSignals & Systemsò, John Wiley. 2. Oppenheim, Wilskey, ñSignals and Systemsò, PHI.	
References	1. B.P.Lathi, ñLinear systems and signalsò, OUP. 2. Paopoulis, ñSignal Analysisò, TMH.	

SET/IN/BT/C305. CIRCUIT THEORY		
Module Name	**Content**	**No. of Hrs.**
Networks and Transients	Review of Network Theorems: Thevenin's& Norton's theorem - Superposition theorem - Maximum power transfer theorem ï Reciprocity Theorem - Millmanôs theorem; Introduction to Network Topology: Definition of basic terms ï Incidence matrix ï Tie-sets - Cut-sets: Analysis and formulation of network equations using tie-set and cut-set; Transients in linear circuits: Initial Conditions - Zero state response - Zero input response - Complete Response ï Analysis of RC and RL circuits with impressed DC voltage ï RC network as differentiator and integrator - Compensated Attenuators ï DC transients in RLC circuits.	11
S-Domain Analysis and Network Functions	S-Domain Analysis of Circuits: Review of Laplace transform - Transformation of a circuit into S-domain - Transformed equivalent of inductance, capacitance and mutual inductance - Impedance and admittance in the transform domain - Node analysis and mesh analysis of the transformed circuit; Network functions: Impulse response and Transfer function - Poles and Zeros ï Restriction of pole and zero locations of network functions - Steady state response and Frequency response from Laplace transform.	12
Two port networks	Characterization in terms of impedance - Admittance - Hybrid and transmission parameters - Inter relationships among parameter sets - Interconnection of two port networks - Series, parallel and cascade. Symmetrical two port networks: T and ´ Equivalent of a two port network. Symmetrical Two Port Reactive Filters: Filter fundamentals - Pass and stop bands - Constant - k low pass filter - Constant - k high pass filter-m-derived T and ´ sections and their applications for infinite attenuation and filter terminations - Band pass and band elimination filters.	11
Network Synthesis	Synthesis: Positive real functions - Driving point functions - Brune's positive real functions - Properties of positive real functions. Testing driving point functions - Application of maximum modulus theorems - Properties of Hurwitz polynomials - Even and odd functions - Strum's theorem - Driving point synthesis - RC elementary synthesis operations - LC network synthesis - Properties of RC network functions - Foster and Cauer forms of RC and RL networks.	8
	Total No. of Hours	**42**
Textbooks	1. D Roy Choudhary, Network and Systems, Wiley Eastern,.	
References	1. Van Valkenburg M E, Network Analysis 3rd Edition, Prentice Hall. 2. Van Valkenberg M.E., Introduction to Modern Network Synthesis, John Wiley and Sons. 3. Franklin. F. Kuo, Network Analysis and Synthesis, John Wiley & sons. 4. Hayt, Kimmerly, Engineering Circuit Analysis, McGraw Hill. 5. Desoer C.A. &Kuh E.S., Basic Circuit Theory, McGraw-Hill. 6. Ryder J.D., Networks, Lines and Fields, Prentice Hall. 7. B. P. Lathi, Linear Systema and Signals, Oxford University Press. 8. DeCarlo, R.A., & Lin, ñLinear Circuit Analysisò, 2 nd Edition, OUP Indian Edition 2003. 9. MahmoodNahvi, Joseph, A. Edminister, ñTheory and Problems of Electric Circuits ï Schaumôs outline seriesò, McGraw Hill. 10. Donald E. Scott, ñAn Introduction to Circuit analysis: A System Approachò McGraw Hill Book Company. 11. A.Chakrabarti,òCircuit Theoryò DhanpatRai& Co.	

SET/EC/BT/C306. ELECTRONIC DEVICES AND CIRCUITS LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Clipping and clamping circuits. 2. Half wave, Full wave rectifiers Bridge Rectifiers. 3. BJT and JFET Biasing schemes and Bias Stability comparison. 4. Emitter follower ï frequency and phase response. 5. Single stage BJT amplifier ï Frequency Response. 6. Single stage JFET amplifier ï Frequency Response. 7. Power amplifier ï Class A, Class B, ClassAB and Class C. 8. Two stage RC coupled amplier ï Frequency Response. 9. Cascode Amplifier ï Frequency Response. 10. Feedback Topologies and amplifiers. 11. Phase Shift Oscillator. 12. Colpitts/Hartley Oscillators. 13. Astable, Monostable and BistableMultivibrator with BJT.	10x2
Spice Simulations	1. Clipping and clamping circuits. 2. Bridge rectifier. 3. Common emitter amplifier with voltage divider biasing- dc, transient, ac analysis. 4. Inverting, Non-Inverting, Difference, Instrumentation Amplifiers.	4x2
	Total No. of Hours	**28**

SET/EC/BT/C307. DIGITAL ELECTRONICS LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Combinational Logic design using basic gates (Code Converters, Comparators). 2. Combinational Logic design using decoders and MUXs. 3. Arithmetic circuits - Half and full adders and subtractors. 4. Arithmetic circuits ï design using adder ICs, BCD adder. 5. Flip flop circuit (RS latch, JK & master slave) using basic gates. 6. Asynchronous Counters. 7. Synchronous counters, Johnson& Ring counters. 8. Sequential Circuit designs (sequence detector circuit). 9. Transfer Characteristics , Measurement of Sinking and Sourcing currents etc. of TTL gates.	10x2
ModelSim Simulations	Writing and simulating programs for adder, decoder, multiplexer, de-multiplexer, up/down counter, universal shift register, Sequence Detector etc.	4x2
	Total No. of Hours	**28**

SET/IN/BT/C308. SIGNALS AND NETWORKS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Programming using MATLAB.	10x2
Module 2	2. Verification of principle of superposition with dc and ac sources. 3. Verification of Thevenin, Norton and Maximum power transfer theorems in ac circuits. 4. Verification of Tellegin's theorem for two networks of the same topology. 5. Determination of transient response of current in RL and RC circuits with step voltage input. 6. Determination of frequency response of current in RLC circuit with sinusoidal ac input.	4x2
	Total No. of Hours	**28**

SET/EC/BT/S309. ELECTRONICS SERVICING LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Familiarization of instruments-voltmeters, ammeters, multimeters (analog, digital), CRO, signal generators. 2. Familiarization of Electronics Devices- Diodes, Transistors, different types of ICs 3. Designing and servicing of various basic electronics circuits (Half wave, Full wave rectifiers, clipper clamper circuits and power supplies). 4. Analog and digital calibration and troubleshooting techniques. 4. Oscilloscopes, Function Generators - Trouble shooting and servicing.	24x2
	Total No. of Hours	**48**

SEMESTER IV

S N	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/EC/BT/C401	Analog Integrated Circuits	3	1	-	10	20	30	70	100	3
2	SET/IN/BT/C402	Microprocessors and Interfacing	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C403	Analog Communication	3	1	-	10	20	30	70	100	3
4	SET/EC /BT/C404	Electromagnetic Field Theory	3	1	-	10	20	30	70	100	3
5	SET/IN/BT/C405	Electrical Measurements and Instrumentation	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C406	Analog Integrated Circuits Lab	-	-	2	30	-	30	70	100	1
7	SET/IN/BT/C407	Microprocessors and Interfacing Lab	-	-	2	30	-	30	70	100	1
8	SET/EC /BT/C408	Analog Communication Lab	-	-	2	30	-	30	70	100	1
9	SET/IN/BT/C409	Electrical Measurement and Instrumentation Lab	-	-	2	30	-	30	70	100	1
10	SET/EC /BT/S410	Mini Project I*			4	30		30	70	100	2
Total			15	5	12	200	100	300	700	1000	21

*Skill Enhancement Course.

L ï Lecture hours, T ï Tutorialhours, P ï Practicalhours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination

SET/EC/BT/C401. ANALOG INTEGRATED CIRCUITS		
Module Name	**Content**	**No. of Hrs.**
Introduction	Operational Amplifiers, DC and AC characteristics; Applications of Op-amp: Precision rectifiers, Log and antilog amplifiers, four quadrant multipliers. Instrumentation amplifier, Sample and Hold Circuits.	9
Active filters	Introduction to filters. Butterworth, Chebyshev & Bessel filter; LC ladder filter ï prototype & synthesis; Frequency transformation of low pass filter. Impedance converters; Gm-C filters, Active-RC Filters; Switched capacitor filter.	8
Multivibrators and Pulse shaping circuits	Multivibrators using op amps; 555 timer; Triggering circuits for bistable and monostable multivibrators; Programmable timer; Pulse shaping circuits.	6
PLL	Analog multiplexer, PLL and its applications, Frequency synthesizers, Coherent synthesizers using PLL, Direct digital synthesis, Phase noise in oscillators.	6
Power supply Regulators	Voltage regulators, Regulators using op amps, IC regulators, Protection circuits, Foldback current limiting, current boosting of IC regulators, switching regulators.	6
DACs and ADCs	D/A Converter ï General considerations, Static non-idealities and Dynamic non-idealities; Current-steering DAC ï Binary weighted DAC, Design issues, Effect of Mismatches. A/D converter ï General considerations, static and dynamic non-idealities; Flash ADC ï Basic architecture, Design issues, Comparator and Latch, Effect of non-idealities, Interpolative and folding architectures. Successive Approximation ADC; Pipeline ADC.	7
	Total No. of Hours	**42**
Textbooks	1.S.Franco, Design with Operational Amplifiers and Analog Integrated Circuits (3/e) TMH, 2003. 2.R.Gayakwad, Op-amps and Linear Integrated Circuits (4/e), PHI. 3.Coughlin, Op-amps and Analog Integrated Circuits, PHI.	
References	1.D.A.Bell, Solidstate Pulse Circuits (4/e), PHI. 2.M.E. Van Valkenburg, Analog Filter Design, Oxford University Press, 1995. 3.R. Schaumann and M.E. Van Valkenburg, Design of Analog Filters, Oxford University Press, 2003. 4.BehzadRazavi, Principles of Data Conversion System Design, Wiley-IEEE Press, 1995. 5.Rudy J. van de Plassche, CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters, Springer, 2003. 6.Choudhury, R. and Jain, S., ñLinear Integrated Circuitsò, 3rd Edition.	

SET/IN/BT/C402. MICROPROCESSORS AND INTERFACING		
Module Name	**Content**	**No. of Hrs.**
Architecture	General 8-bit microprocessor and its architecture- 8085 and similar processors, functional block diagram, architecture, functions of different sections, instruction format, addressing modes, instruction set of 8085 CPU.	8
Assembly Language Programming	Assembly format of 8085, assembly directives, simple programming practices, stack and subroutines.	8
Timing diagrams	Instruction cycle, timing diagrams, different machine cycles, fetch and execute operations, estimation of execution time. Introduction to 16 bit processor.	6
Memory interface design	I/O interfacing methods: I/O mapped I/O, Memory mapped I/O; Interfacing 8085 to memories: 64K x 8, 8K x8, 4Kx 8, 8K x4 interface sample designs.	4
Peripheral interface ICs:	Communication modes, Serial, Parallel communication, simplex, half duplex, full duplex modes; Architecture and functional description of PPI 8255, operating modes: BSR, I/O mode- Mode 0, 1 and 2; Programming 8255; Architecture and functional description of USART 8251, asynchronous and synchronous transmission/ reception, programming 8251.	8
Data Transfer & Interfacing	Data transfer schemes, programmed I/O, interrupt structure of 8085, serial I/O, input/output ports, latches and buffers; interfacing of A/D and D/A converters, RAM, and ROM.	4
DAS and Applications	Data acquisition systems, temperature control, waveform generation and stepper motor control.	4
	Total No. of Hours	**42**
References	1. R. S. Goankar, ñMicroprocessor Architecture, Programming and Applicationsò, Wiley. 2. Mathur A P, ñIntroduction to Microprocessorsò, Tata McGraw Hill. 3. P. K. Gosh & P.R. Sridhar, ñ0000 to 8085 Introduction to Microprocessors for Engineers & Scientistsò. 4. Intel manual.	

SET/EC/BT/C403-ANALOG COMMUNICATION		
ModuleName	**Content**	**No.of Hrs.**
Introduction	An overview of electronic communication system-signals and information, system block Diagram, performance metrics and data rate limits; Signal and Spectra; Orthogonal representation of signals; Random variables and processes: probability, random variables, random processes;	**8**
Amplitude Modulation systems	Need for frequency translation, DSB-SC modulation, DSB-C, SSB, VSB, QAM, FDM, AM and linearity, Radio Transmitter and Receiver; Superheterodyne receiver;	**12**
Angle Modulation	Angle Modulation, phase modulation and frequency modulation, tone modulated FM signal, arbitrary modulated FM signal, FM modulators and demodulators, approximately compatible SSB systems, PLL and applications;	**14**
NoiseandCommunication	Mathematical representation of Noise: sources of noise, frequency domain representation of noise, superposition of noises, linear filtering of noises, quadrature components of noise, representation of noise using orthogonal coordinates; Noise performance of AM/FM/PM systems;	**8**
	TotalNo. ofHours	**42**

Textbooks	1. Taub,Schilling, Goutam, Saha,ñPrinicples of communication systemsò,3rdEdition,TMH. 2. Singh &Sapre,òCommunication System: Analog & Digitalò, 2nd Edition, TMH.
References	1. S. Haykin,Communication systems, John Wiley, 2001. 2. B.P. Lathi, Analog and Digital Communication system

SET/EC/BT/C404-ELECTROMAGNETIC THEORY		
ModuleName	**Content**	**No.of Hrs.**
ReviewofVector Calculus	Orthogonal coordinate systems, Coordinate transformation, Gradient of scalar fields, Divergence and Curl of vector fields.	**3**
Electrostatics	Coulombôs law, electric field, flux and Gaussôs law, curl and divergence of electrostatic fields, electric potential ,Poissonôs equation, Laplaceôs equation, solutions to electrostatic boundary problems, method of images, work and energy in electrostatics ,induced dipoles and polarization, field inside a dielectric, electric displacement, electric susceptibility, permittivity and dielectric constant, boundary conditions, capacitors, surface charge and induced charge on conductors.	**9**
Magneto statics	Lorentz force, Biot-Savartlaw, magnetic flux density, divergence and curl of flux density, Ampereôs law, magnetic vector potential, magnetization, torque and force on magnetic dipoles, magnetic field inside matter, magnetic field intensity, magnetic susceptibility and permeability, magnetic materials, boundary conditions	**9**
Electrodynamics	Electromagnetic induction, inductance, continuity equation, displacement current, Maxwellôs equations, boundary conditions, Poyntingôs theorem, energy and momentum in electromagnetic field.	**6**
Electromagnetic Waves	EM waves in vacuum and in matter, mono chromatic plane waves, group velocity, wave polarization, Lorentz gauge, retarded potentials, TEM modes.	**5**
Refectionandtransmission atinterfaces	Normal and Obliqueincidence of uniformplaneelectromagneticwaves atconducting boundary,dielectricboundary	**5**
Transmission lines	Quasi-TEManalysis,characteristicimpedance,standingwaveratio,impedancematchingtechniques, Smith Chart	**5**
	TotalNo. ofHours	**42**

Textbooks	1. HaytW H, ñElectromagneticsò
References	1. David J Griffiths: IntroductiontoElectrodynamics, Third edition,PHI,1999 2. DavidCheng: Field and WaveElectromagnetics, Secondedition,PearsonEducationAsia,2001 3. NannapaneniNarayanaRao:Elements of EngineeringElectromagnetics,Fifthedition,PHI 4. Matthew N.O.Sadiku: Elements of Electromagnetics,FourthEdition,OxfordUniversityPress 5. JDKrauss: Electromagnetics,Fourthedition,MGH,1992

SET/IN/BT/C405. ELECTRICAL MEASUREMENTS AND INSTRUMENTATION		
Module Name	**Content**	**No. of Hrs.**
Electrical Instruments	DôArsonval Galvanometer. Working principle and operation of PMMC, MI, electrodynamometer and rectifier type instruments. Wattmeters - introduction, electrodynamics type wattmeter, theory, shape of scale, errors. Potentiometers - DC potentiometer - introduction, basic potentiometer circuit, laboratory type, multi-range, precision type, Vernier type, volt ratio box, applications. AC potentiometer - introduction, types, applications. Instrument transformers - introduction, use, ratios, burdens. Current transformers - relationships, errors. Potential transformer - introduction, relationships, errors.	16
Measurements	Measurement of voltage, current, power, power factor and energy. Measurement of resistance - measurement of low (Kelvin double bridge method), medium (ammeter-voltmeter, substitution, Wheatstone bridge & Ohmmeter method) and high resistance (guard circuit, direct deflection, loss of charge and Megohm bridge method) and earth resistance measurement.	16
AC bridges	Sources and detectors, general equation for bridge balance, general form of AC bridge. Self inductance bridges - Maxwellôs inductance, Maxwellôs inductance-capacitance, Hay's, Anderson and Owenôs bridge. Capacitance bridges - Desauty and Schering bridges. Mutual inductance bridges ï Heaviside and Campbell bridges. Frequency bridge ï Wienôs bridge. Sources of errors in bridge circuits.	10
	Total No. of Hours	**42**
References	1. A K Sawhney, ñElectrical and Electronic Measurements and Instrumentationò 2. E. W. Golding & F. E. Widdis, ñElectrical Measurements and Measuring Instrumentsò	

SET/EC/BT/C406. ANALOG INTEGRATED CIRCUITS LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments / Spice Simulations	1. Differential amplifier and Current Source. 2. Measurement of Op-Amp parameters ï CMRR, Slew rate, Open loop. Gain, input and output impedances, Unity gain bandwidth. 3. Inverting non-inverting amplifiers, Integrator, Differentiator ï frequency response. 4. Instrumentation Amplifier using Op-amps and IC ï Gain, CMRR and Input impedance. 5. Op-amp in comparator application. 6. Waveform Generators ï Sine, square, Triangular and Ramp. 7. Schmitt trigger & Precision rectifiers. 8. Astable and Monostable Multivibrators using op-amp and 555IC. 9. Phase Locked Loops. 10. Low Pass Filter and High Pass Filter realizations using op-amps. 11. Band Pass Filter and Band Stop Filter realizations using op-amps. 12. DAC and ADC circuits using op-amp/ICs. 13. Regulated power supply using op amp IC and zener diode.	15x2
	Total No. of Hours	**30**

SET/IN/BT/C407. MICROPROCESSORS AND INTERFACING LAB		
Module Name	**Content**	**No. of Hrs.**
xperiments	1. Familiarization with 8085 microprocessor kit and its keyboard. 2. Exercises with entry and manipulation of data (Different addressing modes). 3. Programming exercises using 8085 microprocessor. 4. Programming exercises to programmable peripheral interface. 5. Programming exercises using interrupts. Memory Interfacing. 6. Interfacing peripheral ICs: 8255, 8251, 8254. 7. Interfacing Stepper motor with 8085.	14x2
	Total No. of Hours	**28**

SET/EC/BT/C408.ANALOG COMMUNICATION LAB		
ModuleName	**Content**	**No.of Hrs.**
Experiments	1. To study AM and determine Depth of Modulation. 2. To study generation of DSB-SC amplitude modulation using balanced modulator. 3. To study generation of SSB amplitude modulated signal. 4. To study envelope detector for demodulation of AM signal and observe diagonal peak clipping effect. 5. To study amplitude demodulation by linear diode detector 6. To study frequency modulation (FM) and determine its modulation factor 7. To study PLL 565 as frequency demodulator. 8. To study the Sensitivity, Selectivity, and Fidelity characteristics of super heterodyne AM receiver.	3x10
	TotalNo. ofHours	**30**

SET/IN/BT/C409. ELECTRICAL MEASUREMENTS AND INSTRUMENTATION LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Study of electrical instruments: MI, PMMC, Dynamometer, wattmeter. Energy meter, potentiometer and instrument transformer. 2. Calibration of instruments: AC voltmeter and ammeter. 3. Wheatstone bridge and Kelvinôs Bridge for Measurement of Resistance. 4. Design, Construction and Calibration of series and shunt type Ohmmeters. 5. Schering Bridge for Capacitance Measurement and Anderson Bridge for Inductance Measurement. 6. Calibration of Single-phase Energy meter and Wattmeter. 7. Testing of Current Transformer.	15x2
	Total No. of Hours	**30**

SET/EC/BT/C410. MINI PROJECT I		
ModuleName	**Content**	**No.of Hrs.**
	Mini Project shall be a bread board/simple printed board implementation of circuit/system involving dc power supply design, discrete components, analog ICs, digital ICs, opamps, relays. Students shall be encouraged to use soldering tools, measuring instruments, datasheets etc.	40
	TotalNo. ofHours	40

SEMESTER V

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/IN/BT/C501	Control Systems	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C502	Digital Communication	3	1	-	10	20	30	70	100	3
3	SET/IN/BT/C503	Electrical Machines	3	1	-	10	20	30	70	100	3
4	SET/EC/BT/C504	VLSI Technology	3	1	-	10	20	30	70	100	3
5	SET/EC/BT/C505	Antenna and Wave Propagation	3	1	-	10	20	30	70	100	3
6	SET/IN/BT/C506	Control Systems Lab	-	-	2	30	-	30	70	100	1
7	SET/EC/BT/C507	Digital Communication and Antenna Lab	-	-	2	30	-	30	70	100	1
8	SET/IN/BT/C508	Electrical Machines Lab	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C509	VLSI Technology Lab	-	-	2	30	-	30	70	100	1
10	SET/EC/BT/S510	Mini Project II*			4	30		30	70	100	2
Total			15	5	12	200	100	300	700	1000	21

*Skill Enhancement Course.

L ï Lecture hours, T ï Tutorialhours, P ï Practicalhours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination

SET/IN/BT/C501. CONTROL SYSTEMS		
Module Name	**Content**	**No. of Hrs.**
Basics of Control	System components - mechanical, hydraulic, pneumatic, electrical and electronic, servos and synchros, stepper motors, basic elements in control systems - open and closed loop system, electrical analogy of physical system, transfer function, block diagram, reduction techniques, signal flow graph.	10
Time Response	Time domain specifications, types of test inputs, I and II order system response, error coefficients, generalized error series, steady state error, PID controller response without and with first order system.	10
Stability of Control Systems	Characteristic equation, location of roots in S-plane for stability, Routh Hurwitz criterion, root locus techniques, construction.	8
Frequency Response	Frequency response - definition, bode plot, polar plot, gain margin and phase margin, Nyquist stability criterion and application.	8
State space analysis	Concepts of state, state variable and state model, state models for linear CT systems, solution of state equation, concept of controllability and observability.	6
	Total No. of Hours	**42**
Textbooks	1. I. G. Nagrath, M. Gopal, ñControl Systemsò.	
References	1. K. Ogata, ñModern Control Enggò. 2. B. C. Kuo, ñAutomatic Control Systemsò.	

SET/EC/BT/C502-DIGITAL COMMUNICATION		
ModuleName	**Content**	**No.ofHrs.**
Elements of digital communication and information theory	Model of a digital communication system, logarithmic measure of information rate, conditional entropy and redundancy, source coding, fixed and variable length codewords, source coding theorem, prefix doing and Kraft inequality, Shannon-Fano and Hauffman coding for 1st, 2^{nd} and 3^{rd} order extensions, maximum entropy of a continuous source(with Gaussian distribution), entropy of bandlimited white Gaussian noise, mutual information and channel capacity of discrete memory less channel, Hartley-Shannon law.	6
Sampling theory and pulse modulation	Sampling theorem, signal reconstruction in time-domain, practical and flat top sampling, sampling of band pass signal, types of analog pulse modulation, method of generation and detection of PWM, PAM and PPM, spectra of pulse modulated systems.	6
Waveform coding Techniques	Discretization in time and amplitude, Linear quantizer, Quantization noise power calculation, signal to quantization noise ratio, non- uniform quantizer, A-law and μ-law companding, encoding and pulse code modulation, bandwidth of PCM, differential pulse code modulation, Delta modulation, Granular noise and slope overload, Adaptive delta modulation, Adaptive DPCM, comparison of PCM and DM, MPEG audio coding standard, Digital Multiplexing.	9
Digital baseband transmission	Line coding and its properties, NRZ and RZ types, Signaling format for unipolar, polar, bipolar(AMI) and Manchester coding and their power spectra(no derivation), HDB and B8ZS signaling, ISI Nyquist criterion for zero ISI and raised cosine spectrum; Matched filter receiver, derivation of its impulse response and peak pulse signal to noise ratio, correlation detector decision threshold and error probability for binary unipolar (on-off) signaling.	6
Digital modulation techniques	Types of Digital modulation, waveform of amplitude modulation, frequency and phase shift keying, method of generation and detection of coherent and non-coherent binary ASK, FSK and PSK, differential phase shift keying, quadrature modulation techniques, (QPSK and MSK) probability of error and comparison of various digital modulation techniques.	6
Error control coding	Error free communication over a noisy channel, Hamming sphere, Hamming distance and bound, relation b/w minimum distance and error detecting and correcting capability, linear block codes, encoding and syndrome decoding, cyclic codes, encoder and decoder for symmetric cyclic codes, convolutional codes, code tree and Treelis diagram, Viterbi and sequential decoding, burst error correction, comparison of performance	7
	TotalNo.ofHours	**40**

Textbooks	1. Taub,Schilling,GoutamSaha,ñPrinciples of communication systemsò,3rdEdition,TMH.
References	1. B.P.Lathi ,ñModern analog and digital communicationò,OxfordUniversityPress 2. ProakisJ.J.ñDigital Communicationò 3. SimonHaykin,ñCommunication Systemò,JohnWiley 4. SimonHaykin,ñDigital Communicationò,JohnWiley 5. Samnugam,ñDigital Communicationò

SET/IN/BT/C503. ELECTRICAL MACHINES		
Module Name	**Content**	**No. of Hrs.**
DC Machines	Constructing feature and principal of operation of shunt, series and compound generators and motors including emf equation and armature reaction. Performance characteristics of generators and motors, starting, speed control and breaking of motors. Two quadrant and four quadrant operation of motors, choice of dc motors for different applications, losses and efficiency.	14
Transformers	Auto transformers, Instrument transformers, three phase transformers.	6
Induction motors	Starters for cage and wound rotor type induction motors, speed control and breaking, single phase induction motors and methods of starting.	10
Synchronous Machines	Construction, emf, effect of pitch and distribution, armature reaction and determination of regulation of synchronous generators, principle of motor operation, effect of excitation on line current (V-curves).method of synchronization, typical applications of ac motors in industries.	12
	Total No. of Hours	**42**
References	1. Nagrath&Kothari, Electrical Machines, Tata McGraw Hill. 2. Bhimra, Electrical Machine. 3. Theraja, Electrical TechonologyVol-II. 4. Cotton H., Advance Electrical Techonology, Wheeler & Co.	

SET/EC/BT/C504-VLSI TECHNOLOGY		
ModuleName	**Content**	**No.of Hrs.**
Introduction	Introduction, Trends & Projections in IC Design & Technology. Comparison between semiconductor materials**.** Basics of Thick and thin Film Hybrid Technology and monolithic chips. Advantages, limitations & Classification of ICs.	7
Monolithic Techniques	Silicon Refining for EGS, Single Silicon Wafer Preparation &Crystal Defects, Epitaxial Process, Diffusion: Ficksô Laws, Oxidation, Ion-Implantation, Photolithography, Basics of Vacuum Deposition & CVD, Etching techniques, Plasma Etching, Metallization and Isolation Techniques.	7
Monolithic Components	Diodes and Transistors, JFETs, MOSFETs, Resistors, Capacitors, MESFETs, Basics of VLSI CMOS technology, Reliability issues in CMOS VLSI, Latching, Electromigration.	7
Assembly Techniques & Packaging of VLSI Devices	Introduction to packaging, Package design considerations, VLSI Assembly techniques, Packaging fabrication technology.	6
Bipolar & MOS Techniques	Flow chart of Bipolar, NMOS and CMOS technologies. Basics of VLSI Design & Process Simulation, SUPREM.	6
Surface Mount Technology (SMT)	Through hole technology, Surface Mount Technology, applications & SM Components.	6
Special Techniques for Modern Processes	Self aligned silicides, hallow junction formation, nitride oxides etc. process flows for CMOS and bipolar IC processes.	5
	TotalNo. ofHours	**44**
Textbooks	1. S.M. Sze, ñ VLSI Technologyò, TMH 2. Eshraghian&Pucknell, ñ Introduction to VLSIò, PHI 3. S.K. Gandhi, ñ VLSI Fabrication Principlesò, John Willey & Sons 4. Botkar, ñ Integrated Circuitsò, Khanna Publishers 5. D.Nagchoudhuri ñ Principles of Microelectronics Technologyò PHI	
References	1. Carmen Capillo, ñSurface Mount Technologyò. 2. S.M. Kang & Y. Leblibici, ñCMOS Digital Integrated Circuits-Analysis and Designò,TMH.	

SET/EC/BT/C505-ANTENNA AND WAVEPROPAGATION		
ModuleName	**Content**	**No.ofHrs.**
Introduction and Antennas Basics	Basic Antenna Parameters, Patterns, Beam Area (or Beam Solid Angle), Radiation Intensity, Beam Efficiency, Directivity, Gain, Resolution, Antenna Apertures, Effective Height, The radio Communication link, Fields from Oscillating Dipole, Single-to-Noise Ratio(SNR), Antenna Temperature, Antenna Impedance. Retarded Potential, Far Field due to an alternating current element Power radiated by a current element Field variation due to sinusoidal current distribution.	9
Point Sources and Their Arrays	Introduction, Point Source, Power Theorem and its Application to an Isotropic Source, Radiation Intensity, Arrays of Two Isotropic Point Sources, Non-isotropic but similar point sources and the principle of Pattern Multiplication, Pattern Synthesis by Pattern Multiplication. Linear Arrays of n Isotropic Point Sources of Equal Amplitude and Spacing, Linear Broadside Arrays with Non-uniform Amplitude Distributions. General Considerations.	8
Electric Dipoles, Thin Liner Antennas and Arrays of Dipoles and Apertures	Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of Short Electric Dipole, Thin Linear Antenna, Radiation Resistance of λ/2 Antenna, Array of Two Driven λ/2 Elements: Broadside Case and End-Fire Case. Yagi-Uda Antenna Design, Long-Wire Antennas, folded Dipole Antennas.	8
Loop antennas and Slot antennas	Loop Antenna. Design and its Characteristic Properties, Application of Loop Antennas, Far Field Patterns of Circular Loop Antennas with Uniform Current. **Introduction:** Slot Antennas, Horn Antennas, Helical Antennas, Log-Periodic Antenna, Micro-strip Antennas.	7
Reflector Antennas	Flat Sheet Reflectors, Corner Reflectors, The Parabola-General Properties, A comparison Between Parabolic and Corner Reflectors, The Paraboloidal Reflector, Reflector Types, Feed Methods for Parabolic Reflectors.	5
Wave Propagation	Plane Earth Reflection, Space Wave and Surface Wave; Space Wave Propagation: Field Strength Relation, Effects of Imperfect Earth, Effects of Curvature of Earth; Sky wave Propagation: structural details of the ionosphere, Wave Propagation Mechanism, Refraction and Reflection of Sky Waves by ionosphere, Ray Path, Critical Frequency, MUF, LUF, OF, Virtual Height and SkipDistance, Relation Between MUF and the Skip Distance, Multi-Hop Propagation, Wave Characteristics.	8
	TotalNo.ofHours	**45**
TextBook:	1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, ñAntennasandWavePropagationò,FourthEdition,TataMcGrawHill,2010SpecialIndian	
ReferenceBooks:	1. K. D. Prasad, ñAntennas and wave propagationò 2. A.R.Harish, M.Sachidananda, ñAntennas and Wave Propagationò, Oxford University Press, 2009.	

SET/IN/BT/C506. CONTROL SYSTEMS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	Related Simulations using MATLAB.	14x2
	Total No. of Hours	**28**

SET/EC/BT/C507.DIGITAL COMMUNICATION AND ANTENNA LAB		
ModuleName	**Content**	**No.of Hrs.**
Experiments	1. Study of Pulse code modulation (PCM) and its demodulation using Bread Board. 2. Study of delta modulation and demodulation. 3. Study of pulse data coding techniques for NRZ formats. 4. Study of Data decoding techniques for NRZ formats. 5. Study of Manchester coding and Decoding. 6. Study of Amplitude shift keying modulator and demodulator. 7. Study of Frequency shift keying modulator and demodulator. 8. Study of Phase shift keying modulator and demodulator. 9. To plot the radiation pattern of a Dipole, Yagi-uda and calculate its beam width. 10. To plot the radiation pattern of Horn, Parabolic & helical antenna. Also calculate beam width & element current.	3x10
	TotalNo. ofHours	**30**

SET/IN/BT/C508. ELECTRICAL MACHINES LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Open circuit characteristic of DC Shunt Generator. 2. Load test on DC Shunt Generator. 3. Speed control of DC Shunt Motor. 4. Brake test on DC Shunt Motor. 5. Brake test on DC Series Motor. 6. Regulation characteristic of three - phase Alternator. 7. Open circuit and short circuit tests on Single - phase Transformer. 8. Load test on Single - phase Transformer 9. Load test on three - phase Induction Motor. 10. Brake test on Single - phase Induction Motor. 11. õVôcurves of Synchronous Motor.	15x2
	Total No. of Hours	**30**

SET/EC/BT/C509. VLSI TECHNOLOGY LAB		
Module	**Content**	**No. of Hrs.**
Module 1	Related Experiments with subject	14x2
	Total No. of Hours	**28**

SET/EC/BT/C510. MINI PROJECT II*		
ModuleName	**Content**	**No.of Hrs.**
	Mini Project shall be a breadboard/simple printed board implementation of circuit/system involving dc power supply design, discrete components, analog ICs, digital ICs , opamps ,relays, specially communication and antenna based projects. Students shall be encouraged to use soldering tools, measuring instruments, datasheets etc.	40
	TotalNo. ofHours	40

SEMESTER VI

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/EC/BT/C601	Digital Signal Processing	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C602	Microwave Engineering	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C603	Microcontrollers and Applications	3	1	-	10	20	30	70	100	3
4	SET/EC/BT/C604	Power Electronics	3	1	-	10	20	30	70	100	3
5	SET/EC/BT/C605	Computer System Architecture	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C606	Digital Signal Processing Lab	-	-	2	30	-	30	70	100	1
7	SET/EC/BT/C607	Microwave Engineering Lab	-	-	2	30	-	30	70	100	1
8	SET/EC/BT/C608	Microcontrollers and Applications Lab	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C609	Seminar	-	-	2	30	-	30	70	100	1
10	SET/EC/BT/S610	Mini Project III*			4	30		30	70	100	2
Total			15	5	12	200	100	300	700	1000	21

*Skill Enhancement Course.

L ï Lecturehours, T ï Tutorialhours, P ï Practicalhours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination.

SET/EC/BT/C601. DIGITAL SIGNAL PROCESSING		
Module Name	**Content**	**No. of Hrs.**
Discrete Time Signals and Systems	Discrete time signals, discrete systems, difference equations, Discrete time Fourier transform (DTFT), Properties of DTFT, frequency domain representation of LTI systems, Sampling and reconstruction of analog signals.	4
Z- Transforms	Bilateral z-transform, important properties of the z-transforms, inverse z-transform, system representation in the z-domain, Implementation of discrete time systems, solution of the difference equations.	6
Discrete Fourier Transform	Discrete Fourier transform, properties of the discrete Fourier transform, linear & circular convolution using DFT, Fast Fourier Transform algorithm, inverse DFT using FFT algorithm.	10
Digital Filter Structures	Characteristics of prototype analog filters, analog-to-digital filter transformations, Basic elements, IIR filter structure, FIR filter structure, lattice filter structures.	10
Filter Design	Design of IIR & FIR filters; Butterworth Chebyshev and Elliptic Approximations; Lowpass, Bandpass, Bandstop and High pass filters, properties of linear-phase FIR filters, window design techniques, Park-McClellan's method.	12
	Total No. of Hours	**42**
References	1. A. Shalivahan, Digital Signal Processing; TMH. 2. A.V. Oppenheim & R.W. Schafer; Digital Signal Processing, Prentice Hall. 3. L.R. Rabiner& B. Gold; Theory and Applications of Digital Signal Processing, PHI. 4. A. Antoniou; Introduction of Digital Filters. 5. C. Emmanuel Ifeachor& W. Jervis Barrie; Digital Signal Processing, A Practical Approach. 6. Vinay K. Ingle & John G. Proakis ; Digital Signal Processing.	

SET/EC/BT/C602- MICROWAVE ENGINEERING		
Units	**Content**	**No. of Hrs.**
Propagation through Waveguide and cavity resonator	Rectangular waveguide, solutions of wave equation in rectangular co-ordinates, derivation of field equations for TE and TM modes degenerate and dominant mode, power transmission and power loss, Excitation of waveguides, nonexistence of TEM mode in waveguide, introduction to circular waveguides, strip line and micro-strip line. Rectangular and cylindrical cavities. Quality factor, excitation of cavities.	12
Microwave components	Waveguide coupling, bends and twists, transitions, directional couplers, matched road, attenuators and phase shifters, E-plane, H-plane, and hybrid Tee, hybrid ring, wave guide discontinuities, windows, irises and tuning screws, detectors, wave meters, isolators and circulators, Scattering matrix.	8
Microwave measurements	Measurements of frequency, wave length, VSWR, impedance, attenuation, low and high power. Limitations of measurements using conventional active devices at microwave frequency.	8
Microwave tubes	Klystron, reflex klystron, magnetron, TWT, BWO: their schematic, principle of operation, performance characteristics and application.	7
Microwave semiconductor devices	PIN, tunnel diode, Gunn diode, IMPATT and TRAPATT, their principle of operation characteristics and application.	7
	Total No. of Hours	**42**
References	1. Liao S. Y. , ñMicrowave devices and circuitsò 2. Pozar, ñMicrowavesò 3. Collin R.E., ñFoundations of Microwave engineeringò	

SET/EC/BT/C603. MICROCONTROLLERS AND APPLICATIONS		
Module Name	**Content**	**No. of Hrs.**
Introduction	Fundamental differences of microprocessors and microcontrollers. Introduction to 8051 μC.	2
Architecture and instruction set.	Introduction of Architecture and instruction set. Addressing modes and data transfer. Special function registers (SFR), I/O ports. 8051 operational code mnemonics: Introduction, 8051 instruction hexadecimal codes, internal RAM and SFR addresses.	15
Counters and timers in 8051	Introduction, applications and Programming of Counters and Timers.	10
Applications	Interfacing - interfacing of switches, thumb wheel switches, seven segment displays, DAC and ADC to microcontroller, LCD interfacing, RTC interfacing.	15
	Total No. of Hours	**42**
Textbooks	1. Kenneth J. Ayala : The 8051 Microcontroller, Penram International. 2. Muhammad Ali Majidi& Janice G. Majidi: The 8051 Microcontroller and Embedded Systems, Pearson.	
References	1. Tim Wilmshurst, An introduction to the design of small-scale embedded systems, Palgrave. 2. Jack Ganssle, The Art of Designing Embedded Systems, Elsevier, 1999. 3. J.W. Valvano, Embedded Microcomputer System: Real Time Interfacing, Brooks/Cole, 2000. 4. R. Gupta, Co-synthesis of Hardware and Software for Embedded Systems, Kluwer 1995.	

SET/EC/BT/C604. POWER ELECTRONICS		
Module Name	**Content**	**No. of Hrs.**
Characteristics of Power Devices	Characteristics of SCR, DIAC, TRIAC, SCS, GTO, PUJT, power transistors, power FET's LASCR, two transistors model of SCR, protection of thyristors against over voltage and over current, dv/dt and di/dt. Commutation Circuits - Turn on circuits for SCR triggering with single pulse and train of pulses - synchronizing with supply, triggering with microprocessor, forced commutation - different techniques, series and parallel operation of SCR.	16
Converter Single Φ	Converters - single phase, half controlled and fully controlled rectifiers, waveforms of load voltage and line current under constant load current, dual converter.	10
Inverters Single Φ	Line commutated and forced commutated inverters, voltage source and current source inverters, parallel inverter, series inverter, PWM inverters, AC & DC choppers, step-up and step-down, cyclo converters. Typical application - AC and DC motor speed control, battery charger, switching mode power supply, uninterruptible power supply, induction and dielectric heating.	16
	Total No. of Hours	**42**
Textbooks	1. P.S.Bhimra, Power Electronics. 2. M.H. Rashid, Power Electronics.	
References	1. N. Mohan, T.M. Undeland& W.P. Robbins, Power Electronics. 2. M.D. singh& K.B. Khanchandani, power electronics.	

SET/EC/BT/C605.COMPUTER SYSTEMARCHITECTURE		
ModuleName	**Content**	**No.of Hrs.**
Introduction	Introduction and overview of computer architecture, basic computer organization, register transfer notation. General aspects of processor design, CPU organization, instruction set architecture, data types, addressing modes, program sequencing.	6
Instructions and Assembly language Programming	Direct, indirect, indexed, relative and immediate addressing mode. Pre and post indexing, instruction formats, zero, one, two and three address machine, different types of instructionsï memory and non-memory reference instructions; Assembly languageï Basic I/O operationsï Stacks and Queues; Assembler, Compiler, Linker;	6
Arithmetic	Basic structure functional blocks, register involved, fetch and execution cycle, instruction sequencing; ALU design: computer arithmetic, fixed and floating points arithmetic, logical operations; design of fast adders ,multiplication and division circuits;	6
Control unit	Control unit concepts, execution of complete instructions, sequencing of control signals, hardware control unit, general micro-programming concepts, micro-programmed control unit, micro-instructions and their encoding.	6
Pipelining	Basic Concepts, Data hazards, Instruction hazards, Influence on Instruction sets; Data path and control considerationï Super scalar operation.	6
Memory System Design	Memory hierarchy, system balance consideration, Speed, size and cost; memory I/O design, cache, ROM, Performance consideration, Virtual memory, Memory management requirements, Secondary storage;	6
Input-Output Organization	Addressing I/O devises, data transfer synchronization, interrupt handling, I/O channels, computer peripherals and interfacing, I/O interfaces, I/O devices, terminals, card readers, I/O processors, Standard I/O Interfaces (PCI, SCSI, USB).	6
	TotalNo. ofHours	**42**

Textbooks	1. MorisM Mano,ñComputer SystemArchitectureò,PHI 2. Hamacher,C.,Vranesic,Z.andZaky, S., ñComputer OrganizationòMcGraw Hill
References	1. Hennesy,Patterson,ñComputer OrganizationandDesign:thehardware/ softwareinterfaceò,MorganKauffman 2. JohnD.Carpenilli,ñComputer Systems OrganizationandArchitectureò

SET/EC/BT/C606. DIGITAL SIGNAL PROCESSING LAB		
Module Name	**Content**	**No. of Hrs.**
Simulations	1. MATLAB simulation for digital filters.	9x2
DSP Processor and Programming	1. Familiarization with DSP processor kit. 2. Familiarization with software for programming the DSP processor.	6x2
	Total No. of Hours	**30**

SET/EC/BT/C607- MICROWAVE ENGINEERING LAB		
ModuleName	**Content**	**No.of Hrs.**
	Related Experiments	3 x 10
	TotalNo. ofHours	**30**

SET/EC/BT/C608.MICROCONTROLLERS AND APPLICATIONS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. Study of 8051 kit 2. Study of KEIL(or any other 8051 compiler), Flash Programmer. 3. 8051 Assembly Language Programming Exercises. 4. Controlling LEDs using microcontroller and programming. 5. Interfacing ADC with Microcontroller and programming. 6. Interfacing DAC with Microcontroller and programming. 7. Interfacing Stepper motor with 8051 and programming. 8. LCD Display Interface with 8051 and programming.	15x2
	Total No. of Hours	**30**

SET/EC/BT/C609. SEMINAR		
Module Name	**Content**	**No. of Hrs.**
	Every Student shall deliver a seminar for 30 minutes. Topic for the seminar shall be decided in consultation with faculty. Topic can be related to an application or a technology which makes use of Electronics And Communication engineering. Students should search for the related literature and prepare a presentation. Evaluation shall be based on content, presentation and active participation.	-
	Total No. of Hours	**-**
References	1. Internet and Journals/Magazines	

SET/EC/BT/S610. MINI PROJECT III*		
Module	**Content**	**No. of Hrs.**
	Mini Project shall be a printed board implementation of circuit/system involving dc power supply design, discrete components, analog ICs, digital ICs, op amps, relays etc. Project must be based on electronics, signal conditioning, communication, Microprocessor and Microcontroller.	24x2
	Total No. of Hours	**48**

SEMESTER VII

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/SH/BT/C701	Principles of Management	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C702	VLSI Deign	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C703	Optical Fiber Communication	3	1	-	10	20	30	70	100	3
4		Elective I	3	1	-	10	20	30	70	100	3
5		Elective II	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C710	VLSI Deign Lab	-	-	2	30	-	30	70	100	1
7	SET/EC/BT/C711	Optical Fiber Communication Lab	-	-	2	30	-	30	70	100	1
8	SET/EC/BT/C712	Project Preparation	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C713	Industrial Training Seminar*	-	-	2	30	-	30	70	100	1
Total			15	5	12	200	100	300	700	1000	21

*Skill Enhancement Course.

L ï Lecturehours, T ï Tutorialhours, P ï Practicalhours, T.A ï Teacher's Assessment, C.T - Class Test, TOT ï Total, ESE - End Semester Examination.

	S. No.	Code	Course Title
Elective I	1	SET/EC/BT/E704	Advance Semiconductor Devices
	2	SET/EC/BT/E705	Telecommunication Switching
	3	SET/EC/BT/E706	Digital Image Processing

	S. No.	Code	Course Title
Elective II	1	SET/EC/BT/E707	Data Communication and Networking
	2	SET/EC/BT/E708	FPGA Based Digital Design
	3	SET/EC/BT/E709	Information Theory and Coding

SET/SH/BT/C701. PRINCIPLES OF MANAGEMENT		
Module Name	**Content**	**No. of Hrs.**
General Management	Nature, scope and significance of management. Process and functions of management. Overview of the functional areas of the general management.	4
Financial Management	Traditional and modern concept of finance function, nature, scope and significance of finance and financial management, functions of financial managers and financial decisions, financial environment.	4
Marketing Management	Nature, concept, scope and significance of marketing management, functions of marketing management, marketing planning and marketing mix.	4
Product Development	Concept, nature, significance of product management, product value, types of products, new product development, product life cycle, functions of product managers.	4
Human Resource Management	Concept, nature, scope, importance of human factor in managing modern organizations, functions of human resource mangers; Planning, organizing, directing, motivation, control and co-ordination.	4
Operations Management	Concept of operations management, tools and techniques: PERT, CEPM, JIT, KANBAN, Inventory management, six sigma, TQM, SCM.	4
Production Management	Concept, nature and significance of production management, functions of production managers.	4
	Total No. of Hours	**28**
Textbooks	1. B. S. Goyal, Production and Operations Management.	
References	1. O. D. W. Koontz, Elements of Management. 2. T. N. Chabara, Principles and Practice of Management. 3. M. Y. Khan, Financial Management. 4. I. M. Pandey, Financial Management. 5. P. Kotler, Marketing Management: Analysis. 6. E. B. Flippo, Principles of Personnel Management.	

SET/EC/BT/C702- VLSIDESIGN		
ModuleName	**Content**	**No.of Hrs.**
Introduction to CMOS	Historical perspective and Mooreôs law; CMOS logic; CMOS fabrication: n-Well process; twin well process; CMOS layout: CMOS inverter layout, layout design rules-well rule, transistor rule, contact rule; Design partitioning; Logic, Circuit and Physical design; Design verification;	5
MOSFET Characteristics and Models	Structure and operation of MOSFET, I-V Characteristics, Channel Length Modulation, Body effect; MOSFET Scaling and Short Channel effects, Narrow channel effects; MOSFET capacitances; Level 1, 2, 3 and BSIMSPICE models for MOSFET; device characterization.	5
CMOS Inverter	Static and Dynamic behavior of CMOS inverter; Estimating delay for CMOS gates and interconnect: Static and Dynamic power consumption.	5
Combinational Circuit families	Static CMOS, ratioed circuits, dynamic circuits: domino logic, pass transistor circuits: CMOS with transmission gates; comparison of circuit families; low power CMOS circuits; speed power product.	5
Sequential circuits	Timing Constraints: max-delay constraint, min-delay constraint, meta-stability; clock skew; conventional CMOS latches and flip-flops, resettable latches and flip-flops, enabled latches and flip-flops;	6
Interconnect	Interconnect parameters and models: ideal wire, lumped model, Lumped RC model, distributed RC model, transmission line model;	5
Data path Subsystem	Adder, Shifter, Multiplier architectures, booth encoding;	8
Memories	SRAM cell read-write operation, DRAM cell, ROM: NORROM, NAND ROM, PROM, EPROM, EEPROM, Flash;	5
	TotalNo. ofHours	**44**
Textbooks	1. NeilH.Weste,DavidHarris,AyanBanerjee,ñCMOS VLSI Design, a circuitsand systems perspectiveò,Pearson. 2. JohnP Uyemura,ñIntroduction to VLSI Systemsò 3. S.M.Kang and Y. Leblebici,CMOS Digital Integrated Circuits ,McGrawHill	
References	1. Pucknell,ñBasicVLSIDesignò 2. JanM.Rabaey, A. Chandrakasan, andB.Nikolic,ñDigital IntegratedCircuits:AdesignPerspectiveòPearsonEducation 3. Michal JohnSebastiansmith,ñApplication-SpecificIntegratedCircuits ñ,Pearson 4. WayneWolf,ñModernVLSIDesign: IPbaseddesignò,Prentice Hall	

SET/EC/BT/C703- OPTICAL FIBER COMMUNICATION		
Units	**Content**	**No. of Hrs.**
Introduction	Block diagram of optical fiber communication system, Advantages of optical fiber communication, Optical fiber waveguides: structure of optical wave guide, light propagation in optical fiber using ray theory, acceptance angle, numerical aperture, skew rays, wave theory for optical propagation, modes in a planar and cylindrical guide, mode volume, single mode fibers, cutoff wavelength, mode field diameter, effective refractive index and group and mode delay factor for single mode fiber	8
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, intramodal and intermodal dispersion for step and graded index fibers, modal noise, over all fiber dispersion for multimode and monomode fiber, dispersion shifted fibers, modal birefringence and polarization maintaining fibers	8
Optical Sources	Basic concepts, Einstein relations and population inversion, optical feedback and threshold conditions, direct and indirect band gap semiconductors, spontaneous and stimulated emission in p-n junction, threshold current density, Hetero junction & DH structure, semiconductor injection lasers structure & Characteristics of injection laser. Drawback and advantages of LED and LASER, LED structures and Characteristics.	8
Optical detectors	Requirement for photo detections, p-n photodiode, characteristics of photo detections, p-i-n and avalanche photodiodes, phototransistors & photoconductors, receiver performance considerations Noise sources in optical fiber communication, noise in p-n, p-i-n and APD receivers, Receiver structures.	8
Optical fiber communication systems	Principal components of an optical fiber communication system, optical transmitter circuits, LED and laser drive circuits, optical receiver block diagram, simple circuits for pre-amplifier, automatic gain control and equalization, Regenerative repeater, BER of optical receiver, channel losses, ISI penalty and optical power budgeting for digital optical fiber system, line coding, Direct intercity and sub carrier intensity modulation using AM, FM and PM. Block diagram and detection principle of coherent optical fiber system,WDM	10
	Total No. of Hours	**42**

References	1. Senior, ñOptical Fiber Communicationò 2. G.E. Keiser, ñOptical Fiber Communicationò

SET/EC/BT/E704- ADVANCE SEMICONDUCTOR DEVICES		
Units	**Content**	**No. of Hrs.**
Review of Semiconductors	Semiconductor Materials and their properties, Carrier Transport in Semiconductors, Excess Carriers in Semiconductor	10
Junctions and Interfaces	Description of p-n junction, Action, The Abrupt Junction, Example of an Abrupt Junction, The linearly graded Junction. The Ideal Diode Model, Real Diodes, Temperature Dependence of I-V Characteristics, High Level Injection Effects, Example of Diodes. Description of Breakdown Mechanism, Zener and Avalanche Breakdown in p-n Junction	8
Majority Carrier Diodes	The Tunnel Diode, The Backward Diode, The Schottkey Barrier Diode, Ohmic Contacts Heterojunctions.	6
Microwave Diodes & Optoelectronic Devices	The Varactor Diode, The p-i-n Diode, The IMPATT Diode, TRAPATT Diode, The BARITT Diode, Transferred Electron Devices. The Solar Cell, Photo detectors, Light Emitting Diodes, Semiconductor Lasers.	8
MOSFETs & Charge Coupled Devices	Basic Types of MESFETs, Models for I-V Characteristics of Short ï Channel MESFETs, High Frequency Performance, MESFETsStructures. Basic Structures and the Operating Principle, I-V Characteristics, Short-Channel Effects, MOSFET Structures, Charge Coupled Devices.	8
	Total No. of Hours	**40**
Textbooks	M.S. Tyagi, ñIntroduction To Semiconductor Materials And Devicesò, John Willy-India Pvt. Ltd.	
References	1. S. M. Sze, ñPhysics of Semiconductor Devicesò, 2nd Edition, John Willy-India Pvt. Ltd. 2. B. G. Streetman and S. Banerjee, ñSolid state electronics devicesò, 5th Edition, PHI.	

SET/EC/BT/E705- TELECOMMUNICATION SWITCHING		
Units	**Content**	**No. of Hrs.**
Introduction	Electronic switching systems: basics of a switching system ï stored program control ï centralized SPC and distributed SPC, space division switching ï strictï sense non-blocking switches ï re arrangeable networks, Synchronous transfer mode- asynchronous transfer mode - time division switching ï TSI operation.	10
switching networks	Multi stage switching networks: Two dimensional switching, Multi-stage time and space switching, implementation complexity of the switches - blocking probability analysis of multistage switches ï Lee approximation - improved approximate analysis of blocking switch - examples of digital switching systems (e.g. AT and T No.5 ESS)	11
Traffic Analysis	Traffic measurements, arrival distributions, Poisson process, holding/service time distributions, loss systems, lost calls cleared ï Erlang-B formula, lost calls cleared model with finite sources, delay systems, Littleôs theorem, Erlang-C formula, M/G/1 model, non-preemptive priority models.	11
Signaling	Customer line signaling - outbandsignaling ï inbandsignaling - PCM signalling - inter register signaling ï common channel signaling principles-CCITT signaling system ï signalling system performance.	6
ATM switching	Introduction to ATM switching ï Fast packet switching ï selfRouting switches ï Banyan network ï ATM switches ï Design of typical switches.	4
	Total No. of Hours	**42**
References	1. Viswanathan T., ñTelecommunication Switching Systems and Networksò, Prentice Hall of India 2.John C. Bellamy, ñDigital Telephonyò Wiley Inter Science Publications 3. Schwartz M., ñTelecommunication Networks - Protocols, Modeling and Analysisò, Pearson 4. Joseph Y Hui," ñSwitching and Traffic Theory for Integrated Broadband Networksò, Kluwer Academic Publishers. 5. Flood J.E., ñTelecommunications Switching Traffic and Networksò, PearsonEducation 6. C.Dhas, V.K.Konangi and M.Sreetharan, ñBroadband Switching, architectures, protocols, design and analysisò, IEEE Computer society press, J. Wiely and Sons INC. 7. Freeman R.L., ñTelecommunication System Engineeringò, John Wiley and Sons,1989 8. TarmoAnttalaien, ñ Introduction to telecommunication network engineeringò, 2nd edition, Artech House, 2003 9. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, ñFundamentals of Telecommunication Networksò, Wiley Interscience 10. R.A.Thompson, ñTelephone switching Systemsò, Artech House Publishers 11. Das J, ñReview of Digital Communication 'State of the Art' in Signalling DigitalSwitching and Data Networksò, Wiley Eastern Ltd., New Delhi, 1988.	

SET/EC/BT/E706-DIGITAL IMAGE PROCESSING		
Module Name	**Content**	**No. of Hrs.**
Module 1	Digital image representation: Basic ideas in digital image processing: problems and applications - Image representation and modeling Sampling and quantization - Basic relationships between pixels - Two dimensional systems - shift in variant linear systems - Separable functions; 2-D convolution; 2-D correlation. Image perception - light, luminance, brightness and contrast - MTF of the visual system - visibility function - monochrome vision models - image fidelity criteria - colour representation - colour matching and reproduction - colour co-ordinate systems - colour difference measures - colour vision models.	8
Module 2	Image transforms: 2-D Discrete Fourier transform - properties; Walsh Hadamard, Discrete Cosine, Haar and Slant transforms; The Hotelling transform. Matrix theory - block matrices and Kronecker products - Circulant matrix formulation for complexity reduction; Algebraic methods - random fields - spectral density function -	8
Module 3	Image enhancement & Restoration: Image enhancement: Basic gray level transformations ï Histogram processing: histogram equalization and modification - Spatial operations - Transforms operations - Multispectral image enhancement - Colour image enhancement Image restoration: Degradation model; Restoration in presence of noise only ï Estimating the degradation function - Inverse _filtering - Wiener _filtering ï Constrained Least Squares filtering.	10
Module 4	Image compression: Fundamental concepts of image compression - Compression models - Information theoretic perspective - Fundamental coding theorem ï Lossless Compression: Huffman Coding- Arithmetic coding ï Bit plane coding ï Run length coding - Lossy compression: Transform coding ï Image compression standards.	9
Module 5	Image segmentation: Detection of Discontinuities ï Edge linking and boundary Description: Local processing ï Global processing ï Hough transform ï Thresholding ï Region based segmentation.	7
	Total No. of Hours	**42**

References	1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, Pearson Education. II Ed.,2002 2. Jain A.K., "Fundamentals of Digital Image Processing,", Prentice-Hall, 1989. 3. Jae S. Lim, Two Dimensional Signal And Image Processing, Prentice-Hall, Inc, 1990. 4. Pratt W.K., "Digital Image Processing", John Wiley, 1991. 5. K. R. Castleman, .Digital image processing., Prentice Hall, 1995. 6. Netravalli A.N. &Hasbell B.G., "Digital Pictures-Representation Compression and Standards", Plenum Press, New York, 1988. 7. Rosenfeld &Kak A.C., "Digital Picture Processing", Vol.1&2, Academic Press, 1982.

SET/EC/BT/E707-DATA COMMUNICATION AND NETWORKING		
Units	**Content**	**No. of Hrs.**
Introduction to networks	Networks: Components and Categories, Types of Connections,Topologies, Transmission Media, Coaxial Cable, Fiber Optics,ISO/OSI Model.	8
Data link layer	Error- Detection and correction, Parity, LRC, CRC, Hammingcode, Low Control and Error control, Stop and wait, ARQ, Slidingwindow, HDLC, LAN, IEEE 802 Standards, Wireless LAN, Bridges.	8
Network layer	Inter-networks, Packet Switching and Datagram approach, IPaddressing methods, Sub-netting, Routing, Distance VectorRouting, Link State Routing, Routers.	8
Transport layer	Duties of transport layer, Multiplexing, De-multiplexing, Sockets,User Datagram Protocol (UDP), Transmission Control Protocol(TCP), Congestion Control, Quality of Services (QOS)	8
Application layer	Domain Name Space (DNS), SMTP, FTP, HTTP ï WWW,Network Security.	4
Industrial Data Networks	RS ï 232 AND RS ï 485, 20ma current loop ï Serial interfaceconverters; MODBUS protocol, Data highway (plus) protocol;HART Protocol; Introduction to ASï interface and Device-Net;Introduction to Profibus; Foundation fieldbus versus Profibus; 10Mbps Ethernet; 100Mbps;	6
	Total No. of Hours	**42**
Textbooks	1. Behrouz A. Forouzan, ñData communication and Networkingò. Tata McGrawHill, 2004 2. Mackay, S., Wrijut, E., Reynders, D. and Park, J., ñPractical Industrial DataNetworks Design, Installation and Troubleshootingò, Newnes Publication,Elsevier, 1st Edition, 2004.	
References	1. Andrew S. Tanenbaum, ñComputer Networksò. PHI, Fourth Edition, 2003. 2. William Stallings, ñ Data and Computer Communicationò, Sixth Edition, PearsonEducation 3. Leon-Garcia, Widjaja: Communication Networks, TMH. 4. Buchanan, W., ñComputer Bussesò, CRC Press, 2000 5. Stallings, W., ñWireless Communication and Networksò, 2nd Edition, PrenticeHall of India.	

SET/EC/BT/E708- FPGA BASED DIGITAL DESIGN		
Module Name	**Content**	**No. of Hrs.**
FPGAs	Role of FPGAs, Types of FPGAs, FPGA vs. Custom VLSI, FPGA based system design; FPGA Fabrics: FPGA architectures, SRAM based FPGAs- logic elements, interconnection networks, configuration, Permanently programmed FPGAs- antifuses, Flash configuration, logic blocks, interconnection networks, programming, Chip I/O; Architecture of FPGA fabrics- logic element parameters, interconnect architecture, pinout;Modeling with HDLs: Simulation algorithms- event driven simulation, simulation events, compiled simulation; Structural vs. Behavioral modeling, Synthesis subset of HDLs, register transfer synthesis;	8
Combinational Logic Design	Logic design process; Combinational network delay, wire and gate delay, fanout, path delay; Power and Energy optimization, glitch analysis and optimization; arithmetic logic and FPGA implementation; physical design for FPGA.	6
Sequential Machine Design	Sequential machine design process, Top-Down Design, State Transition and Register transfer models, Moore and Melay FSM design and modeling ; Rules for clocking, Performance analysis of Flip-Flop based system, Performance analysis of Latch based system, Clock skew, retiming; Case study, Meta-stability, Synchronization;	8
VHDL	Different Descriptions and modeling styles, Simulations Cycles, Process, Loops, Delay Models, Library, Functions, Procedures, Synthesis, Test bench;	10
Design using VHDL	Multiplexer, De-multiplexer, Decoder, Encoder, n-bit adder, Multiplier, Sequence detector- Moore and Melay designs;	5
Testing	Fault models, Different faults, Fault simulation, ATPG, DFT, Boundary scan, BIST;	5
	Total No. of Hours	**42**

Textbooks	1. Wayne Wolf, ñFPGA- Based System Designò, Pearson
References	1. Charles H Roth Jr, ñDigital System Design using VHDLò, Thomson Learning. 2. Digital Design: Principles and Practices - John F Wakerly, Prentice Hall. 3. VHDL for Programmable logic, Kevin Skahil, AdisonWesly. 4. Digital systems Testing and Testable Design - MironAbramovici, Jaico Publishing

SET/EC/BT/E709- INFORMATION THEORY AND CODING		
Module Name	**Content**	**No. of Hrs.**
Module 1	Entropy and Loss-less Source Coding : Entropy, Entropy of discrete random variables- Joint, conditional and relative entropy- Chain rule for entropy, Mutual information and conditional mutual information, Relative entropy and mutual Information; Lossless source coding- Discrete Memory-less sources, Uniquely decodable codes- Instantaneous codes- Kraft's inequality ï Average codeword length, Optimal codes- Huffman coding, Arithmetic Coding, Lemplel-Ziv Coding, Shannon's Source Coding Theorem.	10
Module 2	Channel Capacity and Coding Theorem: Channel Capacity- Discrete memory-less channels (DMC) and channel transition probabilities, Capacity computation for simple channels- Shannonôs Channel Coding Theorem for DMC (proof is optional), Converse of Channel Coding Theorem Continuous Sources and Channels: Differential Entropy- Mutual information- Waveform channels- Gaussian channels- Shannon-Harley Theorem, Shannon limit, efficiency of digital modulation schemes-power limited and bandwidth limited systems.	11
Module 3	Channel Coding- Part-I: Introduction- Error detection and correction, Review of Vector Space, properties, Linear block codes- Construction and decoding, Standard Array decoding, Distance properties. Characteristics of Finite fields- Construction and basic properties of Finite Fields- Computations using Galois Field arithmetic- Extension Fields. Cyclic codes ï Non-systematic and systematic codes-Construction and Decoding- Minimal Polynomials, Conjugates and Conjugacy classes, BCH codes ï Construction and decoding - Reed Solomon codes, Introduction to low density parity check codes.	11
Module 4	Channel Coding- Part-II: Convolutional codes ï Encoder representations and Types- Maximum likelihood decoding - Viterbi decoding, Hard decision and Soft decision decoding, Transfer function of convolutional codes, Interleaving, Concatenated codes, Introduction to Turbo codes.	8
	Total No. of Hours	**40**

Textbooks	
References	1. Thomas M. Cover and Joy A. Thomas, ñElements of Information Theoryò, John Wiley & Sons, 2. Shu Lin and Daniel. J. Costello Jr., ñError Control Coding: Fundamentals and applicationsò, 2nd Ed., Prentice Hall Inc, 2004. 3. John G. Proakis and M. Salehi, ñDigital Communicationò, 5th Ed., MGH, 2008 4. David J. C. MacKay, ñInformation Theory, Inference and Learning Algorithmsò, Cambridge University Press, 2003 5. Robert Gallager, ñInformation Theory and Reliable Communicationò, John Wiley & Sons, 1968. 6. R. E. Blahut, ñTheory and Practice of Error Control Codesò, Addison-Wesley, 1983.

SET/EC/BT/C710–VLSI DESIGNLAB		
Module Name	**Content**	**No.of Hrs.**
Digital VLSI Circuits	1. Learningtool flow of SYNOPSIS/ PYSIX/ CADENCE/Tanner tools (or anyother CADpackageforVLSI). 2. StudyofSPICEmodels for MOSFET. 3. Creating andsimulating basic CMOSgates. 4. Creatinglayout ofCMOSinverter; parasiticextraction;simulation. 5. SimulatingInverter circuit for verifyingeffects of transistorsizing on delayand Power. 6. Creatinglayout for NAND,NOR,AOIand Simulation. 7. Modeling andsimulating a wire. 8. Fan Out4Delay. 9. Designingand simulating a full adder circuit. 10. Designingand simulating a latch/FFand SRAMcell.	2x12
	TotalNo. ofHours	**24**

SET/EC/BT/C711-OPTICAL FIBER COMMUNICATION LAB		
Module Name	**Content**	**No. of Hrs.**
	Related Experiments.	2x12
	Total No. of Hours	**24**

SET/EC/BT/C712- PROJECT PREPARATION		
Module Name	**Content**	**No. of Hrs.**
	Project Preparation includes following assignments. **1.** Survey and study of published literature on the assigned topic; **2.** Working out a preliminary approach to the Problem relating to the assigned topic; **3.** Conducting Preliminary Analysis/ Modelling/ Experiment/Simulation/ Experiment/ Design/ Feasibility **4.** Preparing a Written Report on the Study conducted forpresentation to the Department; **5.** Final Seminar, as oral Presentation before a DepartmentalCommittee.	40
	Total No. of Hours	**40**

SET/EC/BT/C713 - INDUSTRIAL TRAINING SEMINAR*		
ModuleName	**Content**	**No. of Hrs.**
	Student shall prepare a detailed report on her/his industrial training and deliver a seminar of 30 minutes.	2x14
	Total No. of Hours	**28**

SEMESTER VIII

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/EC/BT/C801	Wireless and Mobile Communication	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C802	Embedded Systems	3	1	-	10	20	30	70	100	3
3	**********	Elective III	3	1	-	10	20	30	70	100	3
4	**********	Elective IV	3	1	-	10	20	30	70	100	3
5	SET/EC/BT/C809	Advanced Communication Lab	-	-	2	30	-	30	70	100	1
6	SET/EC/BT/C810	CAD Lab	-	-	2	30	-	30	70	100	1
7	SET/EC/BT/C811	Major Project	-	-	12	30	-	30	70	100	7
Total			12	4	16	130	80	210	490	700	21

	S. No.	Code	Course Title
Elective III	1	SET/EC/BT/E803	Radar Guidance And Navigation
	2	SET/EC/BT/E804	IC Fabrication And Testing
	3	SET/IN/BT/E805	Renewable Energy Engineering

	S. No.	Code	Course Title
Elective IV	1	SET/EC/BT/E806	Satellite Communication
	2	SET/EC/BT/E807	Multimedia Systems And Communication
	3	SET/EC/BT/E808	CMOS Analog IC Design

SET/EC/BT/C801- WIRELESS AND MOBILE COMMUNICATION		
Module Name	**Content**	**No. of Hrs.**
Module 1	Introduction to RF propagation, multi-path fading, mobile channel description and analysis, RF circuits and systems	8
Module 2	Mobile communication concepts, cellular engineering, cellular concepts, frequency allocation, spectrum efficiency, speech coding, modulation/demodulation techniques, multiple access techniques-FDMA, TDMA, CDMA, Spread Spectrum Techniques.	12
Module 3	Error control coding for mobile channel, communication applications, capacity of cellular communication networks, mobile communication standards.	10
Module 4	Wireless data communication systems, wireless multimedia, ATM and IP, paging, wireless local loops. Mobile satellite communication, third generation cellular systems, GSM systems, universal mobile telecommunication systems.	14
	Total No. of Hours	**44**

Textbooks	1. Rappaport, ñWireless Communicationò
References	1. William Stalling, ñWireless Communication and Networksò 2. D. R. KamiloFehar, ñWireless digital communicationò 3. Haykin S &Moher M., ñModern wireless communicationò, Pearson.

SET/EC/BT/C802- EMBEDDED SYSTEMS		
Units	**Content**	**No. of Hrs.**
Embedded Systems	Definition, examples, design considerations and requirements; Embedded design life cycle. Product specifications, Hardware/Software partitioning, Iterations and Implementations, Hardware software integration, Product testing techniques, Hardware Software Co-design concept; System on Chip; Different software tools used for Embedded System design;	5
Embedded Hardware	Processor, Power supply, clock, memory interface, interrupt, I/O ports, Buffers, Programmable Devices, FPGA, CPLD, ASICs etc.; Interfacing with memory and I/O devices; Memory Technologies ï EPROM, Flash, OTP, SRAM, DRAM, SDRAM etc.; Bus architectures like I2C, SPI, AMBA, CAN etc.; Embedded processor selection and trade-offs. Hardware development cycles: Specifications, Component selection, Schematic Design, PCB layout, fabrication and assembly, testing ï functional, manufacturing, parametric;	6
Microcontrollers	Difference between microprocessor and microcontrollers; Special features of microcontrollers for control applications; Architecture of 8-bit microcontroller e.g. 8051, and its instruction set; Interrupt; Timer and Counter; serial communication with 8051; Interfacing microcontroller with memory, IO Devices, DC motor, Stepper motor; Features of advance microcontrollers e.g. WDT, PWM etc.	8
High End Embedded Processors	Introduction to ARM processor architecture and instruction set; Introduction to PowerPC processor architecture and instruction set;	7
Embedded Software	Concept of Firmware; Operating system basics; Device drivers; Real Time Operating System: Fundamentals. Multitasking application ï Threads: execution suspension, sharing, resources between tasks: timers, message queues. Concurrent programming concepts ï Tasks and Events: Synchronization and communication, task scheduling: Time slicing: priority: pre-emption scheduling interrupts and background tasks. Main features of QNX, Vx WORKS and LynxOS, Real Time Embedded System design and development;	12
Design and Testing	Embedded System Design: Embedded System product Development Life cycle (EDLC), Product enclosure Design and Development; Embedded System Development Environment ï IDE, Cross compilation, Simulators/Emulators, Hardware Debugging. Hardware testing methods like Boundary Scan, In Circuit Testing (ICT) etc.	6
	Total No. of Hours	**44**
TextBooks	1. Vahid and Givargis, T., ñEmbedded System Design: A Unified Hardware/ SoftwareIntroductionò, John Wiley and Sons 2. Noergaard, T., ñEmbedded Systems Architecture: A Comprehensive Guide for Engineers and Programmersò, Elsevier Publications 3. Arnold S Berger, ñEmbedded system design: An introduction to processors, Tools,Techniquesò, 4th edition, CMP Books, 1st Edition, 2001. 4. David Simon, An Embedded Software Primer, Addison Wesley, 2000. 5. Shibu K.V.: Introduction to Embedded Systems, Tata McGraw Hill, 2009	
References	1. Tim Wilmshurst, An introduction to the design of small-scale embedded systems, Palgrave, 2. J.W. Valvano, Embedded Microcomputer System: Real Time Interfacing, Brooks/Cole, 2000. 3. David Seal (Ed.), ARM Architecture Reference Manual, 2nd Edition, Addison-Wesley, 2001. 4. Steve Furber, ARM Sytem-on-Chip Architecture, 2nd Edition, Addison-Wesley, 2000. 5. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide, Elsevier, 6. An Implementation guide to Real Time Programming - David L. Ripps, Yourdon Press, 1990. 7. S.Furbur, ARM system Architecture, Addition wesley, 1996. 8. Raj Kamal, Embedded Systems. Architecture, Programming and Design. Tata McGraw Hill. 9. G.H. Miller, Microcomputer Engineering, 3d edition, Pearson Education. 10. Kang, C.M.K., and Shin, G., ñReal Time Systemsò, McGraw Hill	

SET/EC/BT/E803- RADAR GUIDANCE AND NAVIGATION		
Units	**Content**	**No. of Hrs.**
General Management	Block diagram, range equation, performance factors, pulse andCW radar, moving target indicator, pulse, Doppler radar, delay line cancellers, tracking and scanning radar.	10
Radar transmitter and receiver	Different types of radar modulators, receivers block diagram and operations, low noise front ends, receiver protector, radar displays, A-scope and PPI, ends, mixer, duplexer.	10
Navigation Aids	Radio direction finding, loop antenna goniometer, Adcock, error in direction finders, radar bacons, VHF and UHF radio range, LF/MF radio range, VOR, DME, hyperbolic navigation systems, loran-decca-tacan landing systems, GCAs, ILS, MLS, global positioning systems.	12
Guidance	Basic guidance, block diagram, internal guidance, Gyroscopes,Servo accelerators, basic application of server system components.	12
	Total No. of Hours	**44**
References	1. Merril I. Skolnik, ñIntroduction to Radar Systemsò 2. N. S. Nagraja, ñElements of Electronic navigationò 3. R. S. Berkowiz, ñModern Radarò	

SET/EC/BT/E804-IC FABRICATION AND TESTING		
Module Name	**Content**	**No. of Hrs.**
Introduction	Overview of IC technology- CMOS, BIPOLAR, BI-CMOS, SOI; IC design flow; Basic fabrication steps and their significance;	2
Crsystal growth	Crystal structure, lattice, basis, planes, directions, angle between different planes; Crystal growth; Crystal defects; Epitaxy, Clean room; conductivity, resistivity, sheet resistance;	4
Oxidation and Film Deposition	Wet and Dry oxidation; Setups for Oxidation; Various deposition techniques CVD, PVD, evaporation, sputtering, spin coating, LPCVD, Epitaxy, MBE, APCVD;	5
Doping Methods	Diffusion and Ion Implantation: Diffusion process, Solid state diffusion modeling, various doping techniques, Ion implantation, modeling of Ion implantation, statistics of ion implantation, damage annealing, thermal budget, rapid thermal annealing.	5
Lithography and Etching	Photolithography; Positive photo resist, negative photo resist, comparison of photo resists, components of a resist, light sources, exposure, Resolution, Depth of Focus, Numerical Aperture (NA), sensitivity, contrast, need for different light sources, masks, Contact, proximity and projection lithography, EUV lithography, X-ray lithography, e-beam lithography, ion lithography, SCALPEL; Wet etch, Dry etch, Plasma etching, RIE etching, etch selectivity/selective etch, etch directionality;	5
Planarization and Metallization	Planarization Techniques: Need for planarization, Chemical Mechanical Polishing; Metallization and Interconnects: Copper damascene process, Metal interconnects; Multi-level metallization schemes;	5
Process Integration	NMOS process, CMOS:N-well process, Twin well process, CMOS inverter fabrication and masks; Bipolar process; IC Manufacturing;	5
IC Design	Hierarchy, regularity, modularity, locality; Design methods: ε P/DSP, programmable logic, gate array design; cell-based design, full custom design; system on chip; VLSI CAD tools;	4
Testing and Verification	Testing and Verification: logic/ functional verification, manufacturing tests, testers and test programs, logic verification- test benches, regression testing; Manufacturing test principles: fault models, operability, observability, controllability, fault coverage, ATPG; DFT: ad hoc testing, scan design, BIST, IDDQ testing; DFM; Boundary Scan: TAP, TAP architecture, TAP controller, test instruction and data register;	5
Packaging and other issues	Packaging options, package parasitic, heat dissipation; Power distribution, IR drops, L di/dt noise, on chip bypass capacitance; ESD protection; Latch up and its prevention;	4
	Total No. of Hours	**44**

Textbooks	1. Gray S. may, Simon M. Sze, ñFundamentals of Semiconductor fabricationò, Wiley 2. James Plummer, M. Deal and P.Griffin, ñSilicon VLSI Technologyò, Prentice Hall, 2010. 3. Neil H. Weste ,David Harris, Ayan Banerjee, ñCMOS VLSI Design, a circuits and systems perspectiveò, Pearson.
References	1. Jan M. Rabaey, A. Chandrakasan, and B. Nikolic, Digital Integrated Circuits: A design Perspective, Pearson Education, 2002 2. S.M.Kang& Y. Leblebici, CMOS Digital Integrated Circuits, McGraw Hill, 2002

SET/IN/BT/E805. RENEWABLE ENERGY ENGINEERING		
Module Name	**Content**	**No. of Hrs.**
Introduction	Energy sources and their availability- conventional and renewable energy sources, prospects of renewable energy. Energy conservation and energy audit.	4
Solar Energy	Solar radiation and its measurement, solar constant, solar radiation at earth's surface, solar radiation geometry, estimation of average solar radiation, solar radiation at tilted surfaces. Photo-thermal conversion- Physical principles of solar radiation into heat, solar energy collectors- flat plate and focusing type, energy balance equation and collector efficiency, Selective absorbing coatings. Useful heat gained by collector fluid. Solar energy storage systems- solar ponds and extraction of thermal energy. Applications of photo-thermal energy- in agriculture, distillation, pumping cooking, green houses, hydrogen production, etc. Solar photo-voltaic: Principle and materials, solar cells, their combination, storage of photovoltaic energy.	8
Wind Energy	Nature of wind, power of wind, forces on rotor blades, wind energy conversion, energy estimation, site selection considerations, basic components of wind energy conversion system, types of wind machines- horizontal axial and vertical axial machines, aerodynamic forces acting on blades, scheme of electricity generation, generator control, load control, energy storage, applications of wind energy.	8
Energy from Biomass	Biomass conversion technologies- wet and dry processes, photosynthesis, biogas plants, fuel properties of biogas, thermal gasification of biomass.	4
Geothermal energy	Nature of geothermal fields, geothermal sources, energy estimation, application of geothermal energy, materials selection for geothermal power plants.	4
Ocean energy	Ocean thermal energy conversion (OTEC)- open cycle and close cycle OTEC, site selection, energy utilization, energy from tides, components of tidal power plants, Ocean wave energy- Energy conversion devices.	4
Mini and micro hydro	Components, turbine and generators for small scale hydro, protection, control and management of equipments.	4
Chemical energy sources	Fuel cells, design and principle, types, conversion efficiency, types of electrodes, work output and EMF of fuel cells. Batteries- basic theory, types, characteristics, different batteries arrangements. Hydrogen energy- methods of hydrogen production, hydrogen storage, hydrogen as an alternative fuel, safety and management.	6
	Total No. of Hours	**42**
Textbooks	1. D. P. Kothari, ñRenewable Energy Resourcesò, PHI Publications.	
References	1. G. D. Rai, ñNon- conventional sources of energyò, Khanna Publishers, Delhi.	

SET/EC/BT/E806- SATELLITE COMMUNICATION		
Module Name	**Content**	**No. of Hrs.**
Module 1	Introduction: origin and brief history of satellite communication, elements of satellite communication link, current status of satellite communication.	5
Module 2	Orbital mechanism and launching of satellite: equation of orbital, locating the satellite in the orbit, orbital elements, elevation and azimuth calculation, geostationary, and other orbits, mechanics of launching satellite.	7
Module 3	Space craft: satellite subsystems, telemetry, tracking and command (TT and C),communication subsystem, transponders, spacecraft antennas.	7
Module 4	Satellite channel and link design: G/T ratio of earth stations, design of down links and uplinks, FM improvement factor	7
Module 5	Earth station technology: earth station design, earth station, tracking, low noise amplifiers.	7
Module 6	Multiple access techniques: frequency division multiple access (FDMA),FDM/FM/FMFDMA, time division multiple access, frame structure and synchronization, code division multiple access, random access.	9
	Total No. of Hours	**42**
Textbooks	1. Pratt, ñSatellite Communicationò	

SET/EC/BT/E807- MULTIMEDIA SYSTEMS AND COMMUNICATION		
Module Name	**Content**	**No. of Hrs.**
Multimedia components	Introduction - Multimedia skills - Multimedia components and their characteristics - Text, sound, images, graphics, animation, video, hardware.	9
Audio and video compression	Audio compressionï DPCM-Adaptive PCM ï adaptive predictive coding-linear Predictive coding-code excited LPC-perpetual coding Video compression ï principles- H.261-H.263-MPEG 1, 2, 4.	8
Text and image compression	Compression principles-source encoders and destination encoders-lossless and lossy compression-entropy encoding ï source encoding -text compression ï static Huffman coding dynamic coding ï arithmetic coding ï Lempel ziv-welsh Compression , image compression	9
VoIP technology	Basics of IP transport, VoIP challenges, H.323/ SIP ï Network Architecture, Protocols, Call establishment and release, VoIP and SS7, Quality of Service- CODEC Methods-VOIP applicability	8
Multimedia networking	Multimedia networking -Applications-streamed stored and audio-making the best Effort service-protocols for real time interactive Applications-distributing multimedia beyond best effort service-secluding and policing Mechanisms-integrated services, differentiated Services-RSVP.	8
	Total No. of Hours	**42**
Textbooks	1. Fred Halshall, ñMultimedia communication - applications, networks, protocols and standardsò, Pearson education, 2007 2. Tay Vaughan, ñMultideai: making it workò, 7/e, TMH, 2007. 3. Kurose and W.Ross, ñComputer Networking ña Top down approach, Pearson education, 3rd ed, 2005.	
References	1. Marcus goncalves ñVoice over IP Networksò, McGraw Hill, 2. KR. Rao,Z S Bojkovic, D A Milovanovic, ñMultimedia Communication Systems: Techniques, Standards, and Networksò, Pearson Education 2007 3. R. Steimnetz, K. Nahrstedt, ñMultimedia Computing, Communications and 4. Applicationsò, Pearson Education, First ed, 1995. 5. Ranjan Parekh, ñPrinciples of Multimediaò, TMH, 2006	

SET/EC/BT/E808- CMOS ANALOG IC DESIGN		
Units	**Content**	**No. of Hrs.**
Introduction and review	Comparison of MOS and Bipolar Transistors, square-law ,regions ï cutoff , triode, saturation ,biasing , body effect, parasitic and equivalent circuits, short and long channel approximations, noise sources.	6
Building blocks	MOS amplifiers, source followers, cascades, differential stage design, folded cascade stages.	8
Basic operational amplifiers	Stability in opamps, systematic design operational amplifiers	6
Multistage opamp design - I	Fully differential amplifiers, current output amplifiers, rail to railinput and output amplifiers, Class AB and driver amplifiers.	7
Multistage opamp design - II	Feedback voltage and transconductance amplifiers, feedback transimpedance amplifiers and current amplifiers.	7
Regulators	Voltage and current reference circuits, terms - sensitivity Bandgap Reference: Principles, CMOS Bandgaps , Start-Up Circuits	8
	Total No. of Hours	**42**
TextBooks	1. Wiley Sansen: Analog Design Essesntials, Springer 2006	
References	1. Philip E Allen, D R Holberg, ñCMOS Analog IC Designò, Oxford University Press, 2004 2. BehzadRazavi ñDesign of Analog CMOS Integrated Circuitsò, McGraw Hill, 2001 3. BehzadRazavi ñFundamentals of Microelectronic Circuitsò, Wiley 4. Gray, May, ñAnalysis and Design of Analog Integrated Circuitsò, Wiley.	

SET/EC/BT/C809-ADVANCE COMMUNICATION LAB		
Module Name	**Content**	**No. of Hrs.**
	Related Experiments of Satellite Communication, Radar Guidance and Navigation, Microwave, Antenna, Wireless mobile Communication and Telecommunication Switching.	3x10
	Total No. of Hours	**30**

SET/EC/BT/C810-CAD LAB		
Module Name	**Content**	**No. of Hrs.**
	Related Experiments of simulation and designing of Electronics circuits with Multisim, MatLab, LABView. Hands on Practice with NI RIO. DAQ and Elvis Board.	3x10
	Total No. of Hours	**30**

SET/EC/BT/C811- MAJOR PROJECT	
Module	**Content**
	The Major Project will be evaluated on the basis of the weightage of 20% of Report writing, 50% of the Project work and 30% for Presentation and Viva. There shall be two presentations for each Project evaluation and at least one outside expert will be the member of the evaluation committee for final evaluation.