Curriculum and Syllabus

B. TECH.

Electronics and Communication Engineering

(Applicable for 2018-19 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	**4/3**	**3**
Practical	**2**	**1**

2. Induction Program:

Induction Program (mandatory)	**3 weeks duration**
Induction program for students to be offered right at the start of the first year.	**Activities:** (i) Physical activity (ii) Creative Arts (iii) Universal Human Values (iv) Literary (v) Proficiency Modules (vi) Lecture by Eminent People (vii) Visits to local Areas (viii) Familiarization to Dept./Branch & Innovations

***Induction program for students to be offered right at the start of the first year. Appendix –I sheet has attached for details.**

3. 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, EI: Electrical and Instrumentation Engineering,EE: Electrical Engineering, ME: Mechanical Engineering, CS: Computer Science and Engineering, IT: Information Technology, MC: Mandatory Courses, HS: Humanities and Social Sciences including Management courses, 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/M: Mandatory, H: Humanities/A: Applied Science) and next three letters will tell the number according to the semester(for example 801 will tell its 8th 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 V, VI, 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.
*****Induction program for students to be offered right at the start of the first year.

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/EC/BT/C304	Computer Architecture	3	1	-	4	3
5	SET/EI/BT/C305	Signals and Systems	3	1	-	4	3
6	SET/EC/BT/C306	Electronic Measurements and Instruments	3	1	-	4	3
7	SET/EC/BT/C307	Digital Electronics Lab.	-	-	2	2	1
8	SET/EI/BT/C308	Signals and networks Lab.	-	-	2	2	1
9	SET/EC/BT/C309	Electronic Devices and Circuits Lab	-	-	2	2	1
10	SET/MC/BT/M311	Indian Constitution*	-	-	-	Self Study	Qualifying
Total			18	6	6	30	21

*MC: Mandatory Courses (Non-credit))

Semester IV

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C401	Analog Communication	3	1	-	4	3
2	SET/EC/BT/C402	Analog Integrated Circuits	3	1	-	4	3
3	SET/EI/BT/C403	Microprocessors and Microcontrollers	3	1	-	4	3
4	SET/EC/BT/C404	VLSI Devices and Technology	3	1	-	4	3
5	SET/EC/BT/C405	Electromagnetic Field theory	3	1	-	4	3
6	SET/EI/BT/C406	Circuit Theory	3	1	-	4	3
7	SET/EC/BT/C407	Analog Integrated Circuits Lab	-	-	2	2	1
8	SET/EI/BT/C408	Microprocessors and Microcontrollers Lab.	-	-	2	2	1
9	SET/EC/BT/C409	Electronic Circuits Simulation Lab.	-	-	2	2	1
10	SET/MC/BT/M411	*MC-Essence of Indian Traditional Knowledge	-	-	-	Self Study	Qualifying
Total			18	6	6	30	21

*MC: Mandatory Courses (Non-credit))

Semester V

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C501	Digital Communication	3	1	-	4	3
2	SET/EI/BT/C502	Control Systems	3	1	-	4	3
3	SET/EC/BT/C503	CMOS Digital VLSI Design	3	1	-	4	3
4	SET/EC/BT/C504	Microwave Theory and Techniques	3	1	-	4	3
5		Program Elective-I	3	1	-	4	3
6	SET/EC/BT/C506	Communication Lab.	-	-	2	2	1
7	SET/EI/BT/C507	Control Systems Lab.	-	-	2	2	1
8	SET/EC/BT/C508	VLSI Design Lab.	-	-	2	2	1
9	SET/HS/BT/H510	*Foundations of Yoga	3	1	-	4	3
Total			18	6	6	30	21

* Humanities and Social Sciences including Management courses.

List of Program Elective:

S. No.	Code	Course Title
1.	SET/EC/BT/E511	Power Electronics
2.	SET/EC/BT/E512	Speech and audio Processing
3.	SET/EC/BT/E513	Nano Electronics

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	Data Communication and Networking	3	1	-	4	3
3	SET/EC/BT/C603	Antenna and Wave Propagation	3	1	-	4	3
4	SET/EC/BT/C604	Telecommunication Switching	3	1	-	4	3
5		Program Elective-II	3	1	-	4	3
6	SET/EC/BT/C606	Digital Signal Processing Lab	-	-	2	2	1
7	SET/EC/BT/C607	Mini Project	-	-	2	2	1
8	SET/EC/BT/C608	Seminar	-	-	2	2	1
9	SET/SH/BT/A609	* Biology	3	1		4	3
		Total	18	6	6	30	21

*Applied Sciences and Humanities courses

List of Program Elective:

S.No.	Code	Course Title
1	SET/EC/BT/E611	CMOS Analog IC Design
2	SET/EC/BT/E612	Information Theory and Coding
3	SET/EC/BT/E613	Bio-medical Electronics

Semester VII

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C701	Advance Communication Systems	3	1	-	4	3
2		Program Elective-III	3	1	-	4	3
3		Program Elective-IV	3	1	-	4	3
4		#OE-I	3	1	-	4	3
5	SET/EC/BT/C705	Advance Communication Lab.	-	-	2	2	1
6	SET/EC/BT/C706	Industrial Training Seminar	-	-	2	2	1
7	SET/EC/BT/C707	Project Stage-I	-	-	6	6	3
8	SET/HS/BT/H710	*Principles of Management	3	1	-	4	3
		Total	15	5	10	30	20

* Humanities and Social Sciences including Management courses.

#OE: Courses offered by any other department of School of Engineering and Technology

List of Program Elective:

S.No.	Code	Course Title
1.	SET/EC/BT/E711	Fiber Optic Communication
2.	SET/EC/BT/E712	Embedded Systems
3.	SET/EC/BT/E713	Adaptive Signal Processing
4	SET/EC/BT/E714	Wireless Sensor Networks
5	SET/EC/BT/E715	High Speed Electronics
6	SET/EC/BT/E716	Error Correcting Codes

Semester VIII

S. No.	Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	SET/EC/BT/C801	Mobile Communication and Networks	3	1	-	4	3
2		Program Elective-V	3	1	-	4	3
3		Program Elective-VI	3	1	-	4	3
4		#OE -II	3	1	-	4	3
6	SET/EC/BT/C805	Project Stage-II			16	16	8
		Total	12	4	16	32	20

#OE: Courses offered by any other department of School of Engineering and Technology

List of Program Elective:

S.No.	Code	Course Title
1.	SET/EC/BT/E811	RADAR Guidance and Navigation
2.	SET/EC/BT/E812	Satellite Communication
3	SET/EC/BT/E813	Advance Semiconductor Devices
4	SET/EC/BT/E814	Digital Image and Video Processing
5	SET/EC/BT/E815	Mixed signal Design
6	SET/EC/BT/E816	Scientific Computing

Note :

(1) Topic for the Seminar in 6th semester shall be chosen by students in consultation with faculty. Topic shall not be mentioned in the syllabus anywhere, however, it should be related to Electronics and Communication Engineering.

(2) Students shall choose program elective subjects in V, VI, VII and VIII semester each from the given program elective subject table. Open elective subjects are offered by any other department of school of Engineering and Technology. An elective subject shall be offered only when at least 30% of the intake opts for that subject.

(3) Major Project work shall be carried out during the 7th and 8th semester. Students can undertake Major Project individually or in group of not more than four students, under the guidance of a faculty or a group of faculty. Students have to present Synopsis of Major Project during the 7th semester. Feasibility of the Project shall be assessed by the project evaluation committee of the department before the end of 7th semester. However, Major Project would be evaluated in the end of 8th 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	22

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

L - Lecture hours, T – Tutorial hours, P – Practical hours, 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, Euler's 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, Langrange's Method.	13
Probability and Statistics	Binomial Distribution, Normal Distribution and Poisson's Distribution. Correlation and Regression.	8
	Total No. of Hours	**42**
Textbooks	1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers. 2. H K Das, "Advanced Engineering Mathematics", S Chand. 3. Erwin Kreyszig, "Advanced Engineering Mathematics".	
References	1. Shanti Narayan, "A Text Book of Matrices", S. Chand . 2. Finney Thomas, "Calculus and Analytical Geometry", Narosa Publication House. 3. N. Piskunov, "Differential and Integral Calculus".	

SET/SH/BT/C102. PHYSICS		
Module Name	**Content**	**No. of Hrs.**
Optics	Interference: Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Interference in Thin Films, Newton's Rings; Single and n-Slit Diffraction, Diffraction Grating, Raleigh's 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, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser; Introduction to Maser. Diffraction of X-Rays, Bragg's 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, Curie's law, magnetization and hysterisis, Ferromagnetism and Anti-Ferromagnetism.Ferro electricity and Piezoelectricity. Superconductivity in materials.	14
Electromagnetics	Ampere's Law and Displacement Current, Maxwell's 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, "Engineering Physics" 2. Callister W.D., "Materials Science and Engineering: An introduction", 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. " Materials Science and Engineering – A first course" 5th Edition, Prentice Hall, New Delhi, 1998 10. Van Vlack, LH, " Elements of Materials Science and Engineering". 6th Edition, Addison – Wesley Singapore, 1989 11. B. G. Streetman, Solid state Devices, 5th Ed., Pearson (2006) 12. Dekker, "Electrical Engineering Materials", 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 – conversion from one from the other; Kirchhoff's laws – statements; Mesh Analysis; Nodal Analysis; Delta-Star & Star-Delta conversion; Superposition principle; Thevenin's theorem – statement, advantages in case of complex networks; explanation & illustration with examples; Norton's 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
Filter Circuits	Half-wave diode rectifier with RL and RC loads; 1-phase full-wave diode rectifier with L, C and LC filter; 3-phase diode rectifier with L, C and LC filter.	4
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 – 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.	8
Measuring Instruments	DC PMMC instruments – constructional feature and principle of operation; Moving iron meters – 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, "Basic Electrical Engineering," Tata Mc. Graw Hill.	
References	1. A. E. Fitgerald, D.E., Higginbotham and A Grabel, "Basic Electrical Engineering", Mc Graw Hill. 2. Rizzoni, Principles and Applications of Electrical Engineering, TMH. 3. V. Del Toro. "Principles of electrical Engineering, "Prentice hall. 4. W.H. Hayt & J.E. Kemmerly," Engineering circuit Analysis, "Mc Graw Hill. 5. H. Cotton, "Advanced Electrical Technology" 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, "Foundations of Analog and Digital Electronic Circuits", 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, “Computer Fundamentals”. 2. Yadav R. P., “Information Technology”.	
References	1. D S Yadav, “Foundations of IT”, New Age, Delhi. 2. Rajaraman, “Introduction to Computers”, PHI. 3. Peter Nortans “Introduction to Computers”, 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 India's 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.

SET/SH/BT/C106. PHYSICS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	1. To determine the wavelength of monochromatic light by Newton's ring method. 2. To determine the wavelength of monochromatic light by Fresnel's biprism. 3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points. 4. To determine the wavelength of spectral lines using plane transmission grating.	6x2
Module 2	1. Measurement of Magnetic susceptibility- Quincke's Method / Gouy's balance. 2. Mapping of magnetic field.	2x2
Module 3	1. Measurement of e/m of electron – Thomson's experiment. 2. Determination of Planck's 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	
Content	**No. of Hrs.**
1. Study of analog voltmeter, ammeter, digital multimeter and CRO. 2. Verification of KCL and KVL. 3. Verification of Thevenin, Norton Network theorems. 1. Verification of Superposition Network theorem. 2. Verification of MPT Network theorem. 3. Verification of KCL and KVL. 4. Verification of Thevenin, Norton Network theorems. 5. Verification of Superposition Network theorem. 6. Verification of MPT Network theorem. 7. Measurement of efficiency of a single phase transformer by load test. 8. Determination of parameters and losses in single phase transformer by OC and SC test. 9. Measurement of power in a three phase circuit by two wattmeter method. 10. Verification of Single Phase Energy Meter constant. 11. Study of thee phase induction motor. 12. Verification of junction diode, zener diode characteristics. 13. Verification of Clipping and clamping circuits. 14. Verification of H.W. and F.W. rectifier circuit: with and without filter circuit and to determine the ripple factor. 15. Verification of CE characteristics of BJT.	15x2
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 – Different types of lines - Lettering & dimensioning – 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 – First angle and third angle projections – Projection of points in different coordinates – Projections of lines inclined to one of the reference planes.	12
Projections of lines and planes	Projections of lines inclined to both the planes – True lengths of the lines and their angles of inclination with the reference planes – Traces of lines. Projection of plane lamina of geometric shapes inclined to one of the reference planes – 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 – Projections with the axis inclined to one of the planes. Projections of Solids with axis inclined to both the planes – 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 – 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 – Isometric scale – Isometric views – 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	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/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, Drichlet's 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 n" 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 y" = 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, "Higher Engineering Mathematics", Khanna Publishers. 2. H K Das, "Advanced Engineering Mathematics", S Chand. 3. Erwin Kreyszig, "Advanced Engineering Mathematics".	
References	1. J. N. Kapoor, "A Text Book of Differential Equations".	

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, Mohr's stress circle, Poisson's 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, "Engineering Mechanics". 2. P K Nag "Engineering Thermodynamics".	
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, 'Energy Technology', 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/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 – 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, "Engineering Chemistry". 2. Sharma, Kumar, "Engineering Chemistry".	
References	1. R. T. Morrison and R N Boyd, "Organic Chemistry", 6th Edition, Prentice Hall, New Delhi. 2. J. D. Lee, "Concise Inorganic Chemistry", Chapman & Hall. 3. W. L. Jolly, "Modern Inorganic Chemistry", McGraw-Hill. 4. P.W. Atkins, "Physical Chemistry", 6th Edition, Oxford University Press. 5. Barrow, "Physical Chemistry". 6. Manahan, "Environmental Chemistry". 7. D. L. Pavia, GM. Lampman, GS. Kriz and J.R Vyvyan, I, "Spectroscopy", Cengage Learning India Pvt. Ltd, New Delhi, 2007. 8. R.M. Silverstein, F.X. Webster and D.J. Kiemle, "Spectrometric Identification of Organic Compounds", 7th edition, John-Wiley and Sons, New York, 2005. 9. William Kemp, "Organic Spectroscopy", 3rd edition, Palgrave, New York, 2005. 10. C.N. Banwell and E. M. McCash, "Fundamentals of Molecular Spectroscopy", McGraw- Hill, International, UK, 1995. 11. F. Carey, "Organic Chemistry", 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, Varingnon's theorem, Lami's 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, Newton's 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, "Engineering Mechanics". 2. P K Nag "Engineering Thermodynamics".	
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, 'Energy Technology', 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, "Programming in ANSI C".	
References	1. Byron S. Gottfried, "Programming With C". 2. YashwantKanitker, "LET US C". 3. B. W. Kernighan and D. M. Ritchie, "The C Programming Language". 4. B. W. Kernighan, "The Practice of Programming", Addison-Wesley, 1999. 5. C. L. Tondo and S. E. Gimpel, "The C Answer Book", (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 – 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 Mohr's 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/EC/BT/C304	Computer Architecture	3	1	-	10	20	30	70	100	3
5	SET/EI/BT/C305	Signals and Systems	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C306	Electronics Measurements and Instruments	3	1	-	10	20	30	70	100	3
7	SET/EC/BT/C307	Digital Electronics Lab.	-	-	2	30	-	30	70	100	1
8	SET/EI/BT/C308	Signals and networks Lab.	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C309	Electronic Devices and Circuits Lab	-	-	2	30		30	70	100	1
10	SET/MC/BT/M311	Indian Constitution *	-	-	-	-	-	-	-	100	-
										Total	21

MC*: Mandatory Courses(Non-credit))

L – Lecture hours, T – Tutorial hours, P – Practical hours, T.A – Teacher's Assessment, C.T - Class Test, TOT – 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. Legendre's polynomials, Chabyshev polynomials and Bessel's functions and their properties.	14
Integral Transforms	Fourier transform and integral Hankel transforms and Hilbert transforms and their properties, Inverse and their 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, Cauchy's integral theorem, Cauchy's 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, "Higher Engineering Mathematics", Khanna Publishers. 2. H K Das, "Advanced Engineering Mathematics", S Chand. 3. Erwin Kreyszig, "Advanced Engineering Mathematics".	
References	1. Paopoulis, "Signal Analysis", TMH.	

SET/EC/BT/C302. ELECTRONIC DEVICES AND CIRCUITS		
Module Name	**Content**	**No. of Hrs.**
Introduction	Natural signals, need of amplification and linearity, concept of gain, decibel, bandwidth, power dissipation; Concept of biasing and small signal; dc and ac analysis, concept of small signal model, concept of input impedance, output impedance and their estimation; Circuit models for different amplifier types: voltage, current, transconductance, trans-resistance; Introduction to octagon of tradeoffs in analog circuits;	4
Diodes and application	Qualitative analysis of PN Junction diode in different bias conditions: no bias, forward, reverse, breakdown ; Current Voltage characteristic; Exponential Model, Piece wise linear model, constant voltage drop model, ideal diode model, Diode-large signal and small signal operation; Diode Circuits; Introduction and applications of 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, hybrid –π model, Ebres –Mall 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 and their comparison; DC and AC analysis of CS, CS with current source load, CS with diode connected load, CS with degeneration, CG, CD (source follower), and CMOS Cascode amplifier, MOS current mirror; MOS differential amplifier.	10
Frequency Response	Poles and zeroes in circuits, Bode plot, miller's theorem, high frequency models for BJT and MOSFET; transit or cut-off frequency of device; frequency response of CE and CS amplifier and calculation of their poles, zeroes; 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.	6
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; Tuned Amplifiers: basics, inductor losses, transformer coupled amplifiers, amplifier with multiple tuned circuits, cascode and CC-CB cascade, tuning, class C tuned amplifier.	5
	Total No. of Hours	**45**
Textbooks	1. Sedra, Smith, "Microelectronic Circuits", Oxford University Press. 2. Behzad Razavi, "Fundamental of Microelectronic Circuits", Wiley.	
References	1. Millman, Halkias, "Electronic Devices and Circuits". 2. B. G. Streetman, "Solid state Devices", Pearson. 3. David A. Bell, "Electronic Devices and Circuits". 4. R.L.Boylestad, L.Nashelsky, "Electronics Devices & Circuit Theory" PHI.	

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 – 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, “Digital Design”.	
References	1. Taub, Schilieng, “Digital Integrated Electronics”. 2. Anad Kumar, “Digital principles and application”. 3. John F Wakerly, “Digital Design: Principles and Practices”, Prentice Hall. 4. Thomas L. Floyd, “Digital Fundamentals”, Pearson/ Prentice Hall. 5. Ronald J. Tocci, “Digital Systems: Principles and Applications”, Pearson/ Prentice Hall. 6. Charles Roth, “Fundamentals of Logic Design”, Jaico Publishing House.	

SET/EC/BT/C304. COMPUTER ARCHITECTURE		
Module Name	**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.	5
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 instructions – memory and non memory reference instructions; Assembly language – Basic I/O operations – 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, and sequencing of control signals, hardware control unit, general micro-programming concepts, micro-programmed control unit, micro-instructions and their encoding.	6
Pipelined processing	Pipelining, Basic Concepts, Data hazards, Instruction hazards, Influence on Instruction sets; Data path and control consideration – Superscalar operation.	5
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, and I/O processors, Standard I/O Interfaces (PCI, SCSI, and USB).	5
Programmable Logics and HDL	Introduction to CPLDs and FPGAs; Introduction to VHDL and different styles of modeling; VHDL programs for adders, decoder, encoder, 7-segment display decoder, multiplexer, de-multiplexer, up down counter, universal shift register, ALU, Melay and Moore type FSM sequence detector;	6
	Total No. of Hours	**45**
Textbooks	1. Moris M Mano, “Computer System Architecture”, PHI. 2. Roth, “Digital Design using VHDL”	
References	1. Hennesy, Patterson, “Computer Organization and Design: the hardware/ software interface”, Morgan Kauffman. 2. Hamacher, C., Vranesic, Z. and Zaky, S., “Computer Organization” McGraw Hill.	

SET/EI/BT/C305. 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.	8
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	**44**
Textbooks	1. Simon Haykin, "Signals & Systems", John Wiley publications. 2. Oppenheim, Wilskey, "Signals and Systems", PHI publications.	
References	1. B.P.Lathi, "Linear systems and signals", OUP publications. 2. Paopoulis, "Signal Analysis", TMH publications.	

SET/EC/BT/C306. ELECTRONIC MEASUREMENTS AND INSTRUMENTS		
Module Name	**Content**	**No. of Hrs.**
Basics of Measurements	Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. Bridge Measurement: DC bridges- wheatstone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection. Electronic Instruments for Measuring Basic Parameters: Amplified DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter.	10
Oscilloscopes	Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement Techniques, Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope. Signal Generators: Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators. Function Generators.	10
Signal Analysis	Wave Analyzer, Spectrum Analyzer. Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters Transducers: Types, Strain Gages, Displacement Transducers.	12
Digital Data Acquisition System	Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems.IEEE-488 GPIB Bus	10
	Total No. of Hours	**42**
Textbooks	1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education. 2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J.Carr.Pearson Education.	
References	1.. Electronics Instruments and Instrumentation Technology – Anand, PHI 2.. Measurement systems, Doebelin, E.O, McGraw Hill, Fourth edition	

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 – 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
Model Sim 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/EI/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/C309. 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 – frequency and phase response. 5. Single stage BJT amplifier – Frequency Response. 6. Single stage JFET amplifier – Frequency Response. 7. Power amplifier – Class A, Class B, ClassAB and Class C. 8. Two stage RC coupled amplier – Frequency Response. 9. Cascode Amplifier – Frequency Response. 10. Feedback Topologies and amplifiers. 11. Phase Shift Oscillator. 12. Colpitts/Hartley Oscillators. 13. Astable, Monostable and Bistable Multivibrator with BJT.	14x2
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/MC/BT/M311. INDIAN CONSTITUTION		
Module Name	**Content**	**No. of Hrs.**
Introduction	Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	6
Union Government and its Administration	Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha	6
State Government and its Administration	Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	4
Local Administration	District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	8
Election Commission	Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women	7
	Total	**31**

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 Communication	3	1	-	10	20	30	70	100	3
2	SET/EC/BT/C402	Analog Integrated Circuits	3	1	-	10	20	30	70	100	3
3	SET/EI/BT/C403	Microprocessors and Microcontrollers	3	1	-	10	20	30	70	100	3
4	SET/EC/BT/C404	VLSI Devices and Technology	3	1	-	10	20	30	70	100	3
5	SET/EC/BT/C405	Electromagnetic Field Theory	3	1	-	10	20	30	70	100	3
6	SET/EI/BT/C405	Circuit Theory	3	1	-	10	20	30	70	100	3
7	SET/EC/BT/C406	Analog Integrated Circuits Lab.	-	-	2	30	-	30	70	100	1
8	SET/EI/BT/C408	Microprocessors and Microcontrollers Lab.	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C409	Electronic Circuits Simulation Lab.	-	-	2	30	-	30	70	100	1
10	SET/MC/BT/M411	MC: Essence of Indian Traditional Knowledge*	-	-	-	-	-	-	-	100	-
										Total	21

*MC: Mandatory Courses (Non-credit))

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

SET/EC/BT/C401. ANALOG COMMUNICATION		
Module Name	**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**
Noise in Communication	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,"Prinicples of communication systems",3rdEdition,TMH. 2. Singh &Sapre,"Communication System: Analog & Digital", 2nd Edition, TMH.
References	1. S. Haykin,Communication systems, John Wiley, 2001. 2. B.P. Lathi, Analog and Digital Communication system

SET/EC/BT/C402. 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 – 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 – General considerations, Static non-idealities and Dynamic non-idealities; Current-steering DAC – Binary weighted DAC, Design issues, Effect of Mismatches. A/D converter – General considerations, static and dynamic non-idealities; Flash ADC – 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., "Linear Integrated Circuits", 3rd Edition.	

SET/EI/BT/C403. MICROPROCESSORS & MICROCONTROLLERS		
Module Name	**Content**	**No. of Hrs.**
Fundamentals of Microprocessors	Fundamentals of Microprocessor Architecture. 8-bit Microprocessor and Microcontroller architecture. Internal Block Diagram of 8085 microprocessor, Introduction and architecture of to 8086 microprocessor, CPU, ALU, address, data and control bus, Working registers, Stack and Stack Pointer, Program Counter. Instruction set and simple ALP exercises. PPI 8255- architecture, programing and interfacing.	7
The 8051 Architecture	Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles. Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.	8
Instruction Set and Programming	Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and Debugging tools.	8
Memory and I/O Interfacing	Memory and I/O expansion buses, control signals, memory wait states. Interfacing of peripheral devices such as General Purpose I/O, ADC, DAC, timers, counters, and memory devices.	6
External Communication Interface	Synchronous and Asynchronous Communication. RS232, SPI, I2C. Introduction and interfacing to protocols like Blue-tooth and Zig-bee.	7
Applications	LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, and sensor interfacing.	7
	Total No. of Hours	**43**
Textbooks	1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007. 2. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996	
References	1. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004. 2. R. Kamal, "Embedded System", McGraw Hill Education, 2009. 3. D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013. 4. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.	

SET/EC/BT/C404. VLSI DEVICES AND TECHNOLOGY		
ModuleName	**Content**	**No.of Hrs.**
Introduction and PN Junction	Introduction, Evolution, Trends and Projections in IC Design & Technology; Comparison between semiconductor materials, devices and technologies**.** Classification of ICs; Physics of PN Junctions: 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, built in potential, Metal Semiconductor contacts: Rectifying and Ohmic contacts, current voltage characteristics; switching behavior of PN junction, PN Junction capacitances; High Field effects: Tunneling, Hot carrier effect; Modern VLSI Devices;	13
MOSFET	Physics of MOSFET; Structure and operation of MOSFET, I-V Characteristics, Long channel MOSFET: models, subthreshold model, threshold voltage variability with bias and temperature, channel mobility; MOSFET capacitances; Non-Ideal I-V effects: Short channel effects, velocity saturation, CLM, breakdown; MOSFET scaling and challenges; Narrow Channel Effects; MOSFET parasitics, effect of MOSFET device parameters on performance of circuits and memories; Delay Power product; ; Level 1, 2, 3 and BSIM SPICE models for MOSFET; device characterization; Introduction to device circuit codesign;	9
Methods for IC Fabrication	Silicon Refining for EGS, Single Silicon Wafer Preparation &Crystal Defects, Epitaxial Process, Diffusion: Ficks' Laws, Oxidation, Ion-Implantation, Photolithography, Basics of Vacuum Deposition & CVD, Etching techniques, Plasma Etching, Metallization and Isolation Techniques	12
Techniques for Modern Processes	Process Flow of Bipolar, NMOS and CMOS technologies. Basics of VLSI Design & Process Simulation; Introduction to packaging, Package design considerations; VLSI Assembly techniques; Packaging technology; Robustness: PVT variability and design corners, challenges with scaling, statistical analysis of variability, Variation tolerant design; Reliability issues in CMOS VLSI; Latch up, Electro-migration etc. , FITs, MTBF;	7
Selected Topics in VLSI Design and Technology	Low power design: issues, sources of power dissipation, estimation of power dissipation, power dissipation reduction techniques; Modern MOSFET structures and their working: SOI, multi gate FET, GAA etc. Concept of ideal transistor; Current developments in devices;	4
	Total No. of Hours	**45**
Textbooks	1. S. M. Sze, "Semiconductor devices and technology"	
References	1. Neil H. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design, a circuits and systems perspective", Pearson, 4th edition S.M. Sze, " VLSI Technology", 2. S. M. Sze, "Semiconductor Physics" 3. Eshraghian, Pucknell, " Introduction to VLSI", PHI 4. S.K. Gandhi, " VLSI Fabrication Principles", John Willey & Sons 5. Botkar, " Integrated Circuits", Khanna Publishers 6. D.Nagchoudhuri " Principles of Microelectronics Technology" PHI 7. Kaushik Roy, Yeo, "Low Power Low Voltage Subsystems", Tata McGraw Hill	

SET/EC/BT/C405. ELECTROMAGNETIC FIELD THEORY		
Module Name	**Content**	**No. of Hrs.**
Review of Vector Calculus	Orthogonal coordinate systems, Coordinate transformation, Gradient of scalar fields, Divergence and Curl of vector fields.	5
Static fields	Static Electric Field: Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density. Static Magnetic Fields: Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.	8
Transmission Lines	Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.	8
Maxwell's Equations	Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface, Solution of maxwell's equations.	6
Uniform Plane Wave	Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor	8
Plane Waves at a Media Interface	Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.	7
	Total No. of Hours	**42**

Textbooks	1. Hayt W H, "Electromagnetics"
References	1. David J Griffiths: Introduction to Electrodynamics, Third edition,PHI,1999 2. David Cheng: Field and Wave Electromagnetics, Second edition, Pearson Education Asia,2001 3. Nannapaneni Narayana Rao: Elements of Engineering Electromagnetics, Fifth edition, PHI 4. Matthew N.O.Sadiku: Elements of Electromagnetics, Fourth Edition, Oxford University Press 5. J D Krauss: Electromagnetics,Fourth edition, MGH, 1992 6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

SET/EI/BT/C406. 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 – Reciprocity Theorem - Millman's theorem; Introduction to Network Topology: Definition of basic terms – Incidence matrix – 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 – Analysis of RC and RL circuits with impressed DC voltage – RC network as differentiator and integrator - Compensated Attenuators – DC transients in RLC circuits.	12
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 – 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 π 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 π 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.	9
	Total No. of Hours	**44**
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, "Linear Circuit Analysis", 2 nd Edition, OUP Indian Edition 2003. 9. Mahmood Nahvi, Joseph, A. Edminister, "Theory and Problems of Electric Circuits – Schaum's outline series", McGraw Hill. 10. Donald E. Scott, "An Introduction to Circuit analysis: A System Approach" McGraw Hill Book Company. 11. A.Chakrabarti,"Circuit Theory" Dhanpat Rai & Co.	

SET/EC/BT/C407. ANALOG INTEGRATED CIRCUITS LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Differential amplifier and Current Source. 2. Measurement of Op-Amp parameters – CMRR, Slew rate, Open loop. Gain, input and output impedances, Unity gain bandwidth. 3. Inverting non-inverting amplifiers, Integrator, Differentiator – frequency response. 4. Instrumentation Amplifier using Op-amps and IC – Gain, CMRR and Input impedance. 5. Op-amp in comparator application. 6. Waveform Generators –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/EI/BT/C408. MICROPROCESSORS AND MICROCONTROLLERS LAB	
Content	**No. of Hrs.**
1. Familiarization with 8085 microprocessor kit and its keyboard. 2. Exercises with entry and manipulation of data (Different addressing modes). 3. Programming exercises using 8051 microcontroller. 4. Programming exercises to interface LCD with microcontroller. 5. Programming exercises using timers, counters, interrupts. Memory Interfacing. 6. Interfacing serial communication with PC using 8051. 7. Interfacing Stepper motor with 8051.	14x2
Total No. of Hours	**28**

SET/EC/BT/C409. ELECTRONIC CIRCUITS SIMULATION LAB		
Module	**Content**	**No. of Hrs.**
Module 1	Simulation of electronic circuits using spice, VHDL and other simulation software.	14x2
	Total No. of Hours	**28**

SET/MC/BT/M411. ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE		
Module Name	**Content**	**No. of Hrs.**
Environment, Culture, Tradition &Practices	i) Historical overview ii) Oral &codified information on medicinal Plants iii) Water & Water Bodies iv) Fieldwork	10
Urbanization &Urbanism	i) Issues of settlements & Landscapes ii) Social differentiations iii) Communication networks	10
Social inequality &Gender	i) Status within Households: An overview ii) Present context iii) Issues of Violence	10
Cultural Heritage	i) Main components ii) Built Heritage iii) Historical Tourism iv) Cultural Forms	10
Cultural Forms &Cultural Expressions	i) Performing Arts ii) Fairs &Festivals ii) Fieldwork	10
	Total No. of Hours	**20**
References	1. Indu Banga, ed. The City in Indian History: Urban Demography, Society & Polity, Delhi, Manohar,,1991 2. Koch, E. Mughal Art & Imperial Ideology 3. Radha Kumar, History of Doing: An Illustrated Account of Movements for Women's Rights &Feminism in India 1880- 1990,Zubaan, 2007 4. V.Vasudev, Fairs &Festivals, Incredible India Series, 2007 5. V.Singh, The Human Footprint on Environment: Issues in India, New Delhi, and Macmillan, 2012 6. B. Parikh, Composite Culture in a multicultural Society, Delhi, NBT, 2007 7. N. Mehta, Introduction: Satellite Television, Identity & Globalization in Contemporary India in N.Mehta, ED, Television in India, New York, Routledge, 2008 8. R.C. Thakran & Sheo Dutt, ed Bhartiya Upmahaduip ki Sanskritiyan, University of Delhi	

SEMESTER V

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/EC/BT/C501	Digital Communication	3	1	-	10	20	30	70	100	3
2	SET/EI/BT/C502	Control Systems	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C503	CMOS Digital VLSI Design	3	1	-	10	20	30	70	100	3
4	SET/EC/BT/C504	Microwave theory and Techniques	3	1	-	10	20	30	70	100	3
5		Program Elective - I	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C506	Communication Lab.	-	-	2	30	-	30	70	100	1
7	SET/EI/BT/C507	Control Systems Lab.	-	-	2	30	-	30	70	100	1
8	SET/EC/BT/C508	VLSI Design Lab.	-	-	2	30	-	30	70	100	1
9	SET/HS/BT/H510	*Foundation of Yoga	3	1	-	10	20	30	70	100	3
										Total	21

* Humanities and Social Sciences including Management courses.

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

List of Program Elective:

S. No.	Code	Course Title
1	SET/EC/BT/E511	Power Electronics
2	SET/EC/BT/E512	Speech and audio Processing
3	SET/EC/BT/E513	Nano Electronics

SET/EC/BT/C501. DIGITAL COMMUNICATION		
ModuleName	**Content**	**No. of Hrs.**
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, 2nd and 3rd order extensions, maximum entropy of a continuous source(with Gaussian distribution), entropy of band limited 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, Goutam Saha,"Principles of communication systems",3rd Edition,TMH.
References	1. B.P.Lathi ,"Modern analog and digital communication",OxfordUniversityPress 2. ProakisJ.J."Digital Communication" 3. SimonHaykin,"Communication System",JohnWiley 4. SimonHaykin,"Digital Communication",JohnWiley 5. Samnugam,"Digital Communication"

SET/EI/BT/C502. CONTROL SYSTEMS		
Module Name	**Content**	**No. of Hrs.**
Basics of Control	Definitions of control systems, Closed loop and open loop control systems, 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, mathematical modeling and transfer function of different physical systems(mechanical, pneumatic, thermal, hydraulic, electrical) 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 for first and second order system.	10
Stability of Control Systems	Characteristic equation, location of roots in S-plane for stability, Routh Hurwitz criterion, root locus techniques.	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 space models for linear control systems, solution of state equation, state transition matrix, concept of controllability and observability.	8
	Total No. of Hours	**44**
Textbooks	1. I. G. Nagrath, M. Gopal, "Control Systems". Wiley, New York, 1983.	
References	1. K. Ogata, "Modern Control Engg". PHI publications. 2. B. C. Kuo, "Automatic Control Systems". Prentice. Hall.	

SET/EC/BT/C503. CMOS DIGITAL VLSI DESIGN		
Module Name	**Content**	**No. of**
Introduction to CMOS	Historical perspective and Moore's 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; Manufacturing issues; Design Methodology and tools: structured design strategies, design methods, design flows, design economics, data sheets and documentation;	5
CMOS Inverter	Static and Dynamic behavior of CMOS inverter; Estimating delay for CMOS gates and interconnect, Logical Effort method; Concept of Static and Dynamic power consumption and their estimation;	4
Combinational Circuit families	Static CMOS, ratioed circuits, dynamic circuits: domino logic, pass transistor circuits: CMOS with transmission gates; comparison of circuit families including bipolar and BiCMOS; low power CMOS circuits; Low power design techniques; Speed Power product; Energy delay optimization; SOI circuit design, Subthreshold circuit design;	6
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;	5
Interconnect	Wire geometry and inter metal stacks, Interconnect parameters and models: ideal wire, resistance , capacitance, inductance, skin effect, temperature dependence, delay, energy, crosstalk, inductive effects, lumped model, Lumped RC model, distributed RC model, transmission line model; Elmore method, Interconnect engineering: width, spacing, layer; repeaters, crosstalk control, low swing signaling,	5
Data path Subsystem	Different types of Adders and their working: ripple carry, look ahead carry, carry skip, carry save, Manchester carry chain; CMOS circuits for Subtraction, Comparators, Counters; Shifter; Multiplier architectures, unsigned array multiplier, 2's complement array multiplication, booth encoding;	6
Memories	Performance metrics of memories; classification of memories and their comparison, Organization of memory and working; memory cells and its peripherals: address decoder, row circuit, column circuit, sense amplifier; Operation of 6T SRAM cell read-write operation: access time, noise margins, tradeoffs; DRAM cell, ROM: NOR ROM, NAND ROM, PROM, EPROM, EEPROM, Flash; TCAM; Serial access	8
Miscellaneous topics	Power distribution in IC: PDN, IR drops, L di/dt noise, bypass capaciatnce, power filtering, charge pumps, substrate noise, energy scavenging; Clock distribution: issues and solutions; Testing and Verification; Logic verification and its principles, debugging, manufacturing test and its principles, Fault models, observability, controllability, repeatability, survivability, fault coverage, ATPG, delay fault testing, Design for Testability: scan design, BIST, IDDQ Testing; Design for Manufacturing; Boundary scan;	6
	Total No. of Hours	**45**
Textbooks	1. Neil H. Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design, a circuits and systems perspective", Pearson, 4th edition. 2. John P Uyemura, "Introduction to VLSI Systems" 3. S. M. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits " , Mc Graw Hill.	
References	4. Pucknell, "Basic VLSI Design" 5. Jan M. Rabaey, A. Chandrakasan, and B.Nikolic, "Digital Integrated Circuits: A design Perspective", Pearson Education 6. Michal John Sebastian smith, "Application-Specific Integrated Circuits ", Pearson 7. Wayne Wolf, "Modern VLSI Design: IP based design", Prentice Hall	

SET/EC/BT/C504. MICROWAVE THEORY AND TECHNIQUES		
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. , "Microwave devices and circuits" 2. Pozar, "Microwaves" 3. Collin R.E., "Foundations of Microwave engineering"	

SET/EI/BT/E511. 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.	10
Applications	AC and DC motor speed control, battery charger, switching mode power supply, uninterruptible power supply, induction and dielectric heating.	8
	Total No. of Hours	**44**
Textbooks	1. P.S.Bhimra, Power Electronics. Khanna Publication, Delhi. 2. M.H. Rashid, Power Electronics. P.H.I Private Ltd. New Delhi,	
References	1. N. Mohan, T.M. Undeland & W.P. Robbins, Power Electronics. John Wiley & Sons, Inc, 2003. 2. M.D. singh & K.B. Khanchandani, power electronics. Tata McGraw-Hill Education.	

SET/EC/BT/E512. SPEECH AND AUDIO PROCESSING		
Module Name	**Content**	**No. of Hrs.**
Introduction	Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.	7
Speech Signal Processing	Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.	7
Linear Prediction of Speech	Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals – prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.	7
Speech Quantization	Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types. Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.	9
Linear Prediction Coding	LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model. Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zerostate method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP, An overview of ITU-T G.726, G.728 and G.729standards	12
	Total No. of Hours	**42**
Text/ References	1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students Edition), 2004. 2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C. Chu, WileyInter science, 2003.	

SET/EC/BT/E513. NANO ELECTRONICS		
Module Name	**Content**	**No. of Hrs.**
Module1	Introduction to nanotechnology, meso structures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. Kronig-Penny Model. Brillouin Zones.	10
Module2	Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.)	10
Module3	Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors,Carbon nanotube electronics.	11
Module4	Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.	11
		42
Text/ References	1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009 2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, 2003 3. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998 4. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003	

SET/EC/BT/C506. COMMUNICATION LAB		
Module Name	**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 amplitude demodulation by linear diode detector 5. To study frequency modulation (FM) and determine its modulation factor 6. To study PLL 565 as frequency demodulator. 7. To study the Sensitivity, Selectivity, and Fidelity characteristics of Super heterodyne AM receiver. 8.To Study of Pulse amplitude modulation and demodulation 9. To Study of TDM-PAM modulation and demodulation 10. To Study of pulse data coding techniques for NRZ formats. 11. To Study of Data decoding techniques for NRZ formats. 12. To Study of Manchester coding and Decoding. 13. To Study of Amplitude shift keying modulator and demodulator. 14. To Study of Frequency shift keying modulator and demodulator. 15. To Study of Phase shift keying modulator and demodulator. 16. To Study of Pulse code modulation (PCM) and its demodulation. 17. To Study of delta modulation and demodulation	3x10
	Total No. of Hours	**30**

SET/EI/BT/C507. CONTROL SYSTEMS LAB		
Module	**Content**	**No. of Hrs.**
Module 1	Related Simulations using MATLAB.	14x2
	Total No. of Hours	**28**

SET/EC/BT/C508. VLSI DESIGN LAB		
Module	**Content**	**No. of Hrs.**
Module 1	Related Experiments with subject	14x2
	Total No. of Hours	**28**

SET/HS/BT/H510. FOUNDATIONS OF YOGA		
Module	**Content**	**No. of Hrs.**
General Introduction to Yoga	Brief about origin of Yoga: Psychological aspects and Mythological concepts; History and Development of Yoga: prior to the Vedic period, Vedic period, Medival period, modern era; Etymology and Definitions of Yoga, Aim and Objectives of Yoga, Misconceptions of Yoga; Brief about Streams of Yoga; Principles of Yoga, Importance of Yoga. Ashtang Yoga.	8
General Introduction to Indian Philosophy	Philosophy: meaning, definitions and scope; Indian Philosophy: Salient features, Branches (Astika and Nastika Darshanas), Distinction from Religion and Science, Brief introduction to Prasthanatrayee and Purushartha Chatushtaya; Relationship between Yoga and Indian Philosophy.	8
Brief about Yoga in texts – I	Brief to Upanishads and Yoga in Principal Upanishads, Yoga in Yogopanishad; Yogic perspective of Epics: Ramayana and Mahabharata; Yogic perspective: Bhagavad Gita, Yoga Vasishtha.	8
Brief about Yoga in texts – II	Yogic perspective: Smritis, Puranas with emphasis to Bhagavat Purana; Yogic perspective to Shad-darshanas; Brief: Agamas, Tantras, Shaiva Siddhanta.	8
	Total	**32**
Textbooks	1. Lal Basant Kumar : Contemporary Indian Philosophy, Motilal Banarsidas Publishers Pvt. Ltd, Delhi, 2013 2. Dasgupta S. N : History of Indian Philosophy, Motilal Banarsidas, Delhi, 2012 3. Singh S. P : History of Yoga, PHISPC, Centre for Studies in Civilization Ist, 2010 4. Singh S. P & Yogi Mukesh : Foundation of Yoga, Standard Publication, New Delhi, 2010	
References	1. Agarwal M M : Six systems of Indian Philosophy, Chowkhambha Vidya Bhawan, varanai, 2010 2. Swami Bhuteshananda : Nararad Bhakti Sutra, Advaita Ashrama Publication-Dept. Kolkata, II Edition, 2009 3. Hiriyanna M : Outlines of Indian Philosophy, Motilal Banarsidas, Delhi, 2009 4. Hiriyanna M: Essentials of Indian Philosophy, Motilal Banarsidas, Delhi, 2008 5. Radhakrishnan S: Indian Philosophy, Oxford University, UK (Vol. I & II) II Edition, 2008 6. Max Muller K. M : The six system of Indian Philosophy, Chukhambha, Sanskrit series, Varanasi, 6th Edition, 2008	

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	Data Communication and Networking	3	1	-	10	20	30	70	100	3
3	SET/EC/BT/C603	Antenna and Wave Propagation	3	1	-	10	20	30	70	100	3
4	SET/EC/BT/C604	Telecommunication Switching	3	1	-	10	20	30	70	100	3
5		Program Elective-II	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C606	Digital Signal Processing Lab	-	-	2	30	-	30	70	100	1
8	SET/EC/BT/C607	Mini Project	-	-	2	30	-	30	70	100	1
9	SET/EC/BT/C608	Seminar	-	-	2	-	-	-	100	100	1
10	SET/SH/BT/A609	*Biology	3	1	-	10	20	30	70	100	3
										Total	21

* Applied Sciences and Humanities courses

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

List of Program Elective- II:

S.No.	Code	Course Title
1.	SET/EC/BT/E611	CMOS Analog IC Design
2.	SET/EC/BT/E612	Information Theory and Coding
3.	SET/EC/BT/E613	Bio-medical Electronics

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. 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, Hamming code, Low Control and Error control, Stop and wait, ARQ, Sliding window, HDLC, LAN, IEEE 802 Standards, Wireless LAN, Bridges.	8
Network layer	Inter-networks, Packet Switching and Datagram approach, IP addressing methods, Sub-netting, Routing, Distance Vector Routing, 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 –WWW, Network Security.	4
Industrial Data Networks	RS – 232 AND RS – 485, 20ma current loop – Serial interface converters; MODBUS protocol, Data highway (plus) protocol; HART Protocol; Introduction to AS–interface and Device-Net; Introduction to Profibus; Foundation field bus versus Profibus; 10Mbps Ethernet; 100Mbps;	6
	Total No. of Hours	**42**
Textbooks	1. Behrouz A. Forouzan, "Data communication and Networking". Tata McGrawHill, 2004 2. Mackay, S., Wrijut, E., Reynders, D. and Park, J., "Practical Industrial DataNetworks Design, Installation and Troubleshooting", Newnes Publication,Elsevier, 1st Edition, 2004.	
References	1. Andrew S. Tanenbaum, "Computer Networks". PHI, Fourth Edition, 2003. 2. William Stallings, " Data and Computer Communication", Sixth Edition, PearsonEducation 3. Leon-Garcia, Widjaja: Communication Networks, TMH. 4. Buchanan, W., "Computer Busses", CRC Press, 2000 5. Stallings, W., "Wireless Communication and Networks", 2nd Edition, PrenticeHall of India.	

SET/EC/BT/C603. ANTENNA AND WAVE PROPAGATION		
ModuleName	**Content**	**No. of Hrs.**
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 $\lambda/2$ Antenna, Array of Two Driven $\lambda/2$ 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
	Total No. of Hours	**45**
TextBook:	1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and WavePropagation",Fourth Edition,Tata McGraw Hill,2010 Special Indian Edition.	
ReferenceBooks:	1. K. D. Prasad, "Antennas and wave propagation" 2. A.R.Harish, M.Sachidananda, "Antennas and Wave Propagation", Oxford University Press, 2009.	

SET/EC/BT/C604. TELECOMMUNICATION SWITCHING		
Units	**Content**	**No. of Hrs.**
Introduction	Electronic switching systems: basics of a switching system – stored program control –centralized SPC and distributed SPC, space division switching – strict–sense non-blocking switches – re arrangeable networks, Synchronous transfer mode- asynchronous transfer mode - time division switching – 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 – 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 – Erlang-B formula, lost calls cleared model with finite sources, delay systems, Little's theorem, Erlang-C formula, M/G/1 model, non-preemptive priority models.	11
Signaling	Customer line signaling - outbandsignaling – inbandsignaling - PCM signalling - inter register signaling – common channel signaling principles-CCITT signaling system – signalling system performance.	6
ATM switching	Introduction to ATM switching –Fast packet switching – selfRouting switches – Banyan network – ATM switches – Design of typical switches.	4
	Total No. of Hours	**42**
Text / References	1. Viswanathan T., "Telecommunication Switching Systems and Networks", Prentice Hall of India 2.John C. Bellamy, "Digital Telephony" Wiley Inter Science Publications 3. Schwartz M., "Telecommunication Networks - Protocols, Modeling and Analysis", Pearson 4. Joseph Y Hui," "Switching and Traffic Theory for Integrated Broadband Networks", Kluwer Academic Publishers. 5. Flood J.E., "Telecommunications Switching Traffic and Networks", PearsonEducation 6. C.Dhas, V.K.Konangi and M.Sreetharan, "Broadband Switching, architectures, protocols, design and analysis", IEEE Computer society press, J. Wiely and Sons INC. 7. Freeman R.L., "Telecommunication System Engineering", John Wiley and Sons,1989 8. TarmoAnttalaien, " Introduction to telecommunication network engineering", 2nd edition, Artech House, 2003 9. T.N.Saadawi, M.H.Ammar, A.E.Hakeem, "Fundamentals of Telecommunication Networks", Wiley Interscience 10. R.A.Thompson, "Telephone switching Systems", Artech House Publishers 11. Das J, "Review of Digital Communication 'State of the Art' in Signalling DigitalSwitching and Data Networks", Wiley Eastern Ltd., New Delhi, 1988.	

SET/EC/BT/E611. CMOS Analog IC DESIGN		
Units	**Content**	**No. of Hrs.**
Introduction and review	Comparison of MOS and Bipolar Transistors, square-law ,regions – cutoff , triode, saturation, biasing , body effect, channel length modulation, mobility degradation and velocity saturation, threshold voltage effects, temperature and geometry dependence, parasitic and equivalent circuits, short and long channel approximations, types and modelling of noise sources in electronic circuits ; Analog Circuit performance metrics and tradeoffs;	9
Building blocks	Design and Analysis of MOS amplifiers,: CS with different types of loads, CG, source followers, cascodes, folded cascade, current mirrors: simple, cascode current mirror, wide swing cascode current mirror. differential amplifier;	9
Frequency response and Feedback	Frequency analysis of amplifiers;, Different types of Feedback in amplifiers and Analog design; Feedback voltage and transconductance amplifiers, feedback trans-impedance amplifiers and current amplifiers; Stability in Op Amps and compensation;	9
OP AMP Design	OP AMP specifications, Design topologies and their comparison; Tradeoffs in OP AMP Design; Systematic design procedure for one-stage and two-stage OP AMP design.	9
Voltage and Current references	Voltage and current reference circuits: need, , sensitivity issues; Analysis and design of references; Bandgap Reference: Principles, CMOS Bandgap Circuits , Start-Up Circuits;	9
	Total No. of Hours	**45**
TextBooks	1. Wiley Sansen: Analog Design Essesntials, Springer 2006 2. Jacob Baker "CMOS Design Layout and Simulation", Wiley 3. Behzad Razavi "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001	
References	1. Philip E Allen, D R Holberg, "CMOS Analog IC Design", Oxford University Press, 2004 2. Gray, May, "Analysis and Design of Analog Integrated Circuits", Wiley.	

SET/EC/BT/E612. 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 – 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- Shannon's 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 – Non-systematic and systematic codes-Construction and Decoding- Minimal Polynomials, Conjugates and Conjugacy classes, BCH codes – Construction and decoding - Reed Solomon codes, Introduction to low density parity check codes.	11
Module 4	Channel Coding- Part-II: Convolutional codes – 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, "Elements of Information Theory", John Wiley & Sons, 2. Shu Lin and Daniel. J. Costello Jr., "Error Control Coding: Fundamentals and applications", 2nd Ed., Prentice Hall Inc, 2004. 3. John G. Proakis and M. Salehi, "Digital Communication", 5th Ed., MGH, 2008 4. David J. C. MacKay, "Information Theory, Inference and Learning Algorithms", Cambridge University Press, 2003 5. Robert Gallager, "Information Theory and Reliable Communication", John Wiley & Sons, 1968. 6. R. E. Blahut, "Theory and Practice of Error Control Codes", Addison-Wesley, 1983.

SET/EC/BT/E613. BIO-MEDICAL ELECTRONICS		
Module Name		**No. of Hrs.**
Introduction to human physiology	Brief introduction to human physiology. Biomedical transducers: displacement,velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases. Bio-electrodes and biopotential amplifiers for ECG, EMG, EEG, etc.	20
Measurements	Measurement of blood temperature, pressure and flow. Impedance plethysmography. Ultrasonic, X-ray and nuclear imaging .Prostheses and aids: pacemakers, defibrillators, heart-lung machine,artificial lkidney, aids for the handicapped. Safety aspects.	22
	Total No. of Hours	**42**
Textbooks	1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977	
References	2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.	
	3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982	

SET/EC/BT/C606. DIGITAL SIGNAL PROCESSING LAB		
Module Name	**Content**	**No. of Hrs.**
Simulations	1. MATLAB simulation for DTFT, DFT, Z-Transform and digital filters.	11x2
DSP Processor	1. Familiarization with DSP processor kit.	4x2
	Total No. of Hours	**30**

SET/EC/BT/C607. MINI PROJECT		
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**

SET/EC/BT/C608. 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/SH/BT/A609. BIOLOGY		
Module	**Content**	**No. of Hrs.**
Introduction	Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. need to study biology, Brownian motion and the origin of thermodynamics.	3
Classification	Hierarchy of life forms at phenomenological level, classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life.	4
Genetics	Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis, how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes, single gene disorders in humans.	4
Biomolecules	Molecules of life: monomeric units and polymeric structures, sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	4
Enzymes	How to monitor enzyme catalyzed reactions, enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. RNA catalysis.	4
Information Transfer	DNA, Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code Universality and degeneracy of genetic code, gene in terms of complementation and recombination.	4
Macromolecular analysis	protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.	5
Metabolism	Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency, breakdown of glucose to CO2 + H2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO2 and H2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge.	5
	Total No. of Hours	**33**
Textbooks	1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.	
References	2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons. 3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company. 4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher. 5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.	

SEMESTER VII

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1.	SET/EC/BT/C701	Advance Communication Systems	3	1	-	10	20	30	70	100	3
2		Program Elective-III	3	1	-	10	20	30	70	100	3
3		Program Elective-IV	3	1	-	10	20	30	70	100	3
4		#OE-I	3	1	-	10	20	30	70	100	3
5	SET/EC/BT/C705	Advanced Communication Lab.	-	-	2	30	-	30	70	100	1
6	SET/EC/BT/C706	Industrial Training Seminar	-	-	2	-	-	-	100	100	1
6	SET/EC/BT/C707	Project Stage-I	-	-	6	-	-	50	150	200	3
7	SET/HS/BT/H710	*Principles of Management	3	1	-	10	20	30	70	100	3
										Total	20

* Humanities and Social Sciences including Management courses.

#OE: Courses offered by any other department of School of Engineering and Technology

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

List of Program Elective III & IV:

S.No.	Code	Course Title
1.	SET/EC/BT/E711	Fiber Optic Communication
2.	SET/EC/BT/E712	Embedded Systems
3.	SET/EC/BT/E713	Adaptive Signal Processing
4	SET/EC/BT/E714	Wireless Sensor Networks
5	SET/EC/BT/E715	High Speed Electronics
6	SET/EC/BT/E716	Error Correcting Codes

SET/EC/BT/C701. Advance Communication Systems		
Units	**Content**	**No. of Hrs.**
Basics of Optical Communication	Elements 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, Transmission properties in optical fiber, Sources and detector used in optical communication.	11
Elements of RADAR Systems	Block diagram, range equation, performance factors, pulse and CW radar, moving target indicator, pulse, RADAR modulators, Radio direction finding, loop antenna, radar bacons, VHF and UHF radio range, VOR, DME, Block diagram of basic guidance and its application.	11
Introduction to Satellite Communication	Origin and brief history of satellite communication, elements of satellite communication link, current status of satellite communication, orbital mechanism, equation of orbital, locating the satellite in the orbit, orbital elements, elevation and azimuth calculation satellite subsystems, transponders, LNA.	10
TV and Displays	TV Transmitters and Receivers, Synchronization, TV Pictures: Geometric form and aspect ratio, image continuity, interlaced scanning, picture resolution, Composite video signal: horizontal and vertical synchronization, scanning sequences, Perception of brightness and colours, additive colour mixing, video signal for colours, luminance signal, LCD, LED and OLED displays and their comparison.	10
	Total No. of Hours	**42**

Text/References	1. John M. Senior, "Optical Fiber Communication" 2. Merril I. Skolnik, "Introduction to Radar Systems" 3. Pratt, "Satellite Communication" 4. R.R.Gulati,Modern "Television Practice, Principles, "Technology and Servicing"

SET/EC/BT/E711. Fiber Optic Communications		
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. John.M.Senior, “Optical Fiber Communication” 2. G.E. Keiser, “Optical Fiber Communication”

SET/EC/BT/E712. 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 – 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 – 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 – Threads: execution suspension, sharing, resources between tasks: timers, message queues. Concurrent programming concepts – 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 – 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., "Embedded System Design: A Unified Hardware/ SoftwareIntroduction", John Wiley and Sons 2. Noergaard, T., "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Elsevier Publications 3. Arnold S Berger, "Embedded system design: An introduction to processors, Tools,Techniques", 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., "Real Time Systems", McGraw Hill	

SET/EC/BT/E713. ADAPTIVE SIGNAL PROCESSING		
Units	**Content**	**No. of Hrs.**
Introduction	General concept of adaptive filtering and estimation, applications and motivation, Review of probability, random variables and stationary random processes, Correlation structures, properties of correlation matrices.	8
Optimal Filter	Optimal FIR (Wiener) filter, Method of steepest descent, extension to complexvalued The LMS algorithm (real, complex), convergence analysis, weight errorcorrelation matrix, excess mean square error and mis-adjustment	8
Variants of the LMS algorithm	The sign LMS family, normalized LMSalgorithm, block LMS and FFT based realization, frequency domain adaptive filters, Sub-band adaptive filtering. Signal space concepts - introduction to finite dimensional vectorspace theory, subspace, basis, dimension, linear operators, rank and nullity, inner product space, orthogonality, GramSchmidt orthogonalization, concepts of orthogonal projection,orthogonal decomposition of vector spaces.	8
Vector space of random variables	Correlation as inner product, forward andbackward projections, Stochastic lattice filters, recursive updating of forward and backward prediction errors, relationship with AR modeling, joint process estimator, gradient adaptive lattice.	8
Introduction to recursive least squares	Introduction to recursive least squares, vector space formulation of RLSestimation, pseudo-inverse of a matrix, time updating of inner products, development of RLS lattice filters, RLS transversal adaptive filters. Advanced topics: affine projection and subspace based adaptive filters, partial update algorithms, QR decomposition and systolic array.	10
	Total No. of Hours	**42**

References	ykin, Adaptive filter theory, Prentice Hall, 1986. 2. C.Widrow and S.D. Stearns, Adaptive signal processing, Prentice Hall, 1984

SET/EC/BT/E714. WIRELESS SENSORS NETWORKS		
Units	**Content**	**No. of Hrs.**
Introduction	Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks	8
Mobile Ad-hoc Networks	Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks, Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee,	10
Dissemination protocol	Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.	8
Design Principles	Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.	8
Single-node architecture	Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.	8
	Total No. of Hours	**42**

Text/References	negus Dargie , Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011 2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009 3. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevier Publications,2004 4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science

SET/EC/BT/E715. HIGH SPEED ELECTRONICS		
Units	**Content**	**No. of Hrs.**
Transmission line theory	Transmission line theory (basics) crosstalk and nonideal effects; signal integrity: impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, methodologies for design of high speed buses; radiated emissions and minimizing system noise	8
Noise Analysis	Sources, Noise Figure, Gain compression, Harmonic distortion, Inter modulation,Cross-modulation, Dynamic range	7
Devices	Passive and active, Lumped passive devices (models), Active (models, low vs high frequency)	8
RF Amplifier Design	Stability, Low Noise Amplifiers, Broadband Amplifiers (and Distributed) Power Amplifiers, Class A, B, AB and C, D E Integrated circuit realizations, Cross-over distortion Efficiency RF power output stages, Mixers –Upconversion, Downconversion, Conversion gain and spurious response.Oscillators Principles.PLL Transceiver architectures	10
Printed Circuit Board Anatomy	CAD tools for PCB design, Standard fabrication, Microvia Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges.	9
	Total No. of Hours	**42**

Text/References	en H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press as H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", CambridgeUniversity Press, 2004, ISBN 0521835399. 3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN 0-13-887571-5.

SET/EC/BT/E716. ERROR CORRECTING CODES		
Units	**Content**	**No. of Hrs.**
Linear block codes	Systematic linear codes and optimum decoding for the binary symmetric channel; Generator and Parity Check matrices, Syndrome decoding on symmetric channels	10
Hamming codes	Weight enumerators and the McWilliams identities; Perfect codes, Introduction to finite fields and finite rings;factorization of (X^n-1) over a finite field; Cyclic Codes.	10
BCH codes	Idempotents and Mattson-Solomon polynomials; Reed-Solomon codes, Justeen codes, MDS codes, Alterant, Goppa and generalized BCH codes; Spectral properties of cyclic codes. ;Decoding of BCH codes	10
Berlekamp's decoding	Berlekamp's decoding algorithm, Massey's minimum shift register synthesis technique and its relation to Berlekamp's algorithm. A fast Berlekamp - Massey algorithm. Convolution codes; Wozencraft's sequential decoding algorithm, Fann's algorithm and other sequential decoding algorithms; Viterbi decoding algorithm.	12
	Total No. of Hours	**42**

Text/References	McWilliams and N.J.A. Slone, The theory of error correcting codes, 1977. Balahut, Theory and practice of error control codes, Addison Wesley, 1983.

SET/EC/BT/C705. ADVANCE COMMUNICATION SYSTEMS LAB		
Module Name	**Content**	**No. of Hrs.**
	Related Experiments of Optical Communication, Satellite Communication, Radar Guidance and Navigation, Microwave, Antenna and Telecommunication Switching.	3x10
	Total No. of Hours	**30**

SET/EC/BT/C706. 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**

SET/EC/BT/C707 Project Stage-I		
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 for presentation to the Department; 5. Final Seminar, as oral Presentation before a Departmental Committee.	40
	Total No. of Hours	**40**

SET/HS/BT/H710. 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.	6
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.	6
Marketing Management	Nature, concept, scope and significance of marketing management, functions of marketing management, marketing planning and marketing mix.	6
Product Development	Concept, nature, significance of product management, product value, types of products, new product development, product life cycle, functions of product managers.	6
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.	6
Operations Management	Concept of operations management, tools and techniques: PERT, CEPM, JIT, KANBAN, Inventory management, six sigma, TQM, SCM;	6
Production Management	Concept, nature and significance of production management, functions of production managers.	6
	Total No. of Hours	**42**
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	

SEMESTER VIII

SN	Code	Course Title	L	T	P	T.A	C.T	TOT	ESE.	SUB. TOTAL	Credits
1	SET/EC/BT/C801	Mobile Communication and Networks	3	1	-	10	20	30	70	100	3
2		Program Elective-V	3	1	-	10	20	30	70	100	3
3		Program Elective-VI	3	1	-	10	20	30	70	100	3
4		#OE-II	3	1	-	10	20	30	70	100	3
6	SET/EC/BT/C805	Project Stage-II	-		16	-	-	50	250	300	8
										Total	20

#OE: Courses offered by any other department of School of Engineering and Technology.

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

List of Program Elective V & VI:

S.No.	Code	Course Title
1.	SET/EC/BT/E811	RADAR Guidance and Navigation
2.	SET/EC/BT/E812	Satellite Communication
3	SET/EC/BT/E813	Advance Semiconductor Devices
4	SET/EC/BT/E814	Digital Image and Video Processing
5	SET/EC/BT/E815	Mixed signal Design
6	SET/EC/BT/E816	Scientific Computing

SET/EC/BT/C801. MOBILE COMMUNICATION AND NETWORKS		
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, "Wireless Communication"
References	1. William Stalling, "Wireless Communication and Networks" 2. D. R. KamiloFehar, "Wireless digital communication" 3. Haykin S &Moher M., "Modern wireless communication", Pearson.

SET/EC/BT/E811 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, "Introduction to Radar Systems" 2. N. S. Nagraja, "Elements of Electronic navigation" 3. R. S. Berkowiz, "Modern Radar"	

SET/EC/BT/E812. 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,geosyncronous 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, "Satellite Communication"	

SET/EC/BT/E813. 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 –Channel MESFETs, High Frequency Performance, MESFETs Structures. 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, “Introduction To Semiconductor Materials And Devices”, John Willy-India Pvt. Ltd.	
References	1. S. M. Sze, “Physics of Semiconductor Devices”, 2nd Edition, John Willy-India Pvt. Ltd. 2. B. G. Streetman and S. Banerjee, “Solid state electronics devices”, 5th Edition, PHI.	

SET/EC/BT/E814. DIGITAL IMAGE AND VIDEO 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 – 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 – Estimating the degradation function - Inverse _filtering - Wiener _filtering – Constrained Least Squares filtering.	8
Module 4	Image compression: Fundamental concepts of image compression - Compression models - Information theoretic perspective - Fundamental coding theorem – Lossless Compression: Huffman Coding- Arithmetic coding – Bit plane coding – Run length coding - Lossy compression: Transform coding – Image compression standards.	8
Module 5	Fundamentals of Video Coding- Inter-frame redundancy, motion estimation techniques – full search, fast search strategies, forward and backward motion prediction, frame classification – I, P and B; Video sequence hierarchy – Group of pictures, frames, slices, macro-blocks and blocks; Elements of a video encoder and decoder; Video coding standards – MPEG and H.26X,.Video Segmentation- Temporal segmentation–shot boundary detection, hard-cutsand soft-cuts; spatial segmentation – motion-based; Video object detection and tracking.	10
	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/E815. MIXED SIGNAL DESIGN		
Module Name	**Content**	**No. of Hrs.**
Module 1	Analog and discrete-time signal processing, introduction to sampling theory; Analog continuous time filters: passive and active filters; Basics of analog discrete-time filters and Z-transform.	8
Module 2	Switched-capacitor filters- Non idealities in switched-capacitor filters; Switched-capacitor filter architectures; Switched-capacitor filter applications.	8
Module 3	Basics of data converters; Successive approximation ADCs, Dual slope ADCs, Flash ADCs, Pipeline ADCs, Hybrid ADC structures, High-resolution ADCs, DACs.	12
Module 4	Mixed-signal layout, Interconnects and data transmission; Voltage-mode signaling and data transmission; Current-mode signaling and data transmission. Introduction to frequency synthesizers and synchronization; Basics of PLL, Analog PLLs; Digital PLLs; DLLs.	14
	Total No. of Hours	**42**

Text/References	1. R. Jacob Baker, CMOS mixed-signal circuit design, Wiley India, IEEE press, reprint 2008 2. Behzad Razavi , Design of analog CMOS integrated circuits, McGraw-Hill, 2003. 3. R. Jacob Baker, CMOS circuit design, layout and simulation, Revised second edition, IEEE press, 2008. 4. Rudy V. dePlassche, CMOS Integrated ADCs and DACs, Springer, Indian edition, 2005. 5. Arthur B. Williams, Electronic Filter Design Handbook, McGraw-Hill, 1981.

SET/EC/BT/E816. SCIENTIFIC COMPUTING		
Module Name	**Content**	**No. of Hrs.**
Module 1	Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy, Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation	8
Module 2	System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems, Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting	8
Module 3	Eigenvalues and singular values: Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD, Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares	9
Module 4	Interpolation:Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation, Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation, Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigenvalue Problems	9
Module 5	Partial Differential Equations,Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods, Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets,Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences	8
	Total No. of Hours	**42**

Text/References	1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, 2nd Ed., 2002 2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007 3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., 2nd Ed., 2008 4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, 1st Ed., 2006

SET/EC/BT/C805 PROJECT STAGE-II
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.

Mandatory Induction Program for Electronics and Communication Engineering Branch

3 weeks duration
• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lectures by Eminent People • Visits to local Areas • Familiarization to Dept./Branch & Innovations

***Induction program for students to be offered right at the start of the first year.**

1. Induction Program:

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the institution, right at the start. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

1.1 Physical Activity:

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

1.2 Creative Arts:

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

1.3 Universal Human Values:

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through dos and don'ts but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program. Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

1.4 Literary:

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

1.5 Proficiency Modules:

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

1.6 Lectures by Eminent People:

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

1.7 Visits to Local Area:

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

1.8 Familiarization to Dept. /Branch & Innovations:

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.