

Course Structure and Syllabus For B. Tech. Electronics and Telecommunication Engineering Programme

With effect from the Academic Year

2010-2011 (First Year), 2011-2012 (Second Year), 2012-2013 (Third Year), 2013-2014 (Final Year)





	Semester I			
Code	Course of Study	L	Р	C
BH101	Basic Course in Communicative English	3	0	6
BH102	Engineering Mathematics - I	4	0	8
BH103	Engineering Physics - I	3	2	8
BH104	Engineering Chemistry - I	3	2	8
EM105	Engineering Mechanics	3	0	6
ID106	Energy and Environmental Engineering	2	0	4
WS107	Workshop Practice	0	4	4
EX108	EX108 Branch Specific Course*		0	6
XC109	NCC/NSS/Sports	0	0	0
Total			8	50
Semester II				
Code	Course of Study	L	Р	С
BH201	Basic Course in Human Rights	2	0	4
BH202	Engineering Mathematics - II	4	0	8
BH203	Engineering Physics - II	3	2	8
BH204	Engineering Chemistry - II	3	2	8
CL205	Basic Civil Engineering	2	0	4
ME206 Basic Mechanical Engineering		2	0	4
ME207	Engineering Graphics***	1	4	6
EX208	Branch Specific Programming and Softwares**	3	0	6
XC209	NCC/NSS/Sports	0	0	0
	Total	20	8	48

*EX108: Introduction to Electronics and Telecommunication Engineering, for EXTC Department

- ** EX208: Electronics and Telecommunication Engineering: Programming and Softwares, for Electronics and Telecommunication Engineering Department
- *** ME207: Four Hours End Semester Examination

	Semester III					
CODE	COURSE OF STUDY	L	Р	С	MSE	ESE
BET301	Engineering Mathematics III	4	0	8	30	70
BET302	Electronic Devices and Circuits I	4	0	8	30	70
BET303	Digital Electronics	4	0	8	30	70
EE304	Network Analysis	4	0	8	30	70
BET305	Numerical Methods and Computer Programming	4	0	8	30	70
BET306	Electrical Technology	4	0	8	30	70
BET307	Seminar Report & Presentation*	0	0	4	50	0
BET308	NSS/NCC/Sports/Arts					
		24	0	52	230	420
Semester IV						
CODE	COURSE OF STUDY	L	Р	C	MSE	ESE
BET401	Microprocessor	4	0	8	30	70
BET402	Electronic Devices and Circuits II	4	0	8	30	70
BET403	Signals and Systems	4	0	8	30	70
BET404	Principles of Communication	4	0	8	30	70
BET405	Elective-I	3	0	6	30	70
А	Linear Algebra					
В	Electronic Measurements & Instruments					
С	Industrial Instrumentation					
BET407	Communication Engineering Laboratory I***	0	6	6	50	50
BET408	Industrial Exposure [#]	0	0	0	0	0
XC409	NSS/NCC/Sports/Arts	0	0	0	0	0
		19	6	48	250	40 0

* BET307: Self Study Report on any Topic of choice based on the Subject studied so far or beyond

*** BET407: Practical of Electronic Devices and Circuits I, Digital Electronics, Numerical Methods & Computer Programming and Electrical Technology courses

#BET408: Two Weeks in Electronics or Telecommunication Industry

	Semester V					
CODE	COURSE OF STUDY	L	Р	С	MSE	ESE
BET501	Analog Circuits	4	0	8	30	70
BET502	Microcontrollers and Applications	4	0	8	30	70
BET503	Digital Signal Processing	4	0	8	30	70
BET 504	Electromagnetic Fields	4	0	8	30	70
BET 505	Elective II	3	0	6	30	70
А	Probability and Random Processes					
В	Nano electronics: Devices and Materials					
С	Digital Voice & Picture Communication					
BET506	Electronic Workshop	0	4	4	50	50
BET507	Communication Engineering Laboratory II*	0	4	4	50	50
BET508	08 Communication Engineering Laboratory III**		4	4	50	50
BET509	Industrial Exposure***	0	0	4	50	
XC509	NSS/NCC/Sports/Arts					
		19	12	54	350	500
	Semester VI					
CODE	COURSE OF STUDY	L	Р	С	MSE	ESE
BET601	Control Engineering	4	0	8	30	70
BET602	Advanced Antenna Theory	4	0	8	30	70
BET603	Digital Communication	4	0	8	30	70
BET604	Digital Systems Design	4	0	8	30	70
BET605	Elective III	3	0	6	30	70
А	MEMS and Microsystems					
В	Power Electronics					
С	Advanced 3G and 4G Wireless Mobile					
BET606	Communication Engineering Laboratory IV [#]	0	4	4	50	50
BET607	Communication Engineering Laboratory V##	0	4	4	50	50
BET608	Industrial Training ^{###}	0	0	0	0	0
<u>YC600</u>	NCC /NCC /Casarta / Arta	0	0	Δ	0	0
AC009	NSS/NCC/Sports/Arts	0	U	0	0	0

* BET507: Practical of Electronic Devices and Circuits II and Signals and Systems

** BET508: Practical of Principles of Communication and Microprocessor.

***BET509: Evaluation of Two Weeks Industrial Exposure

#BET606: Practical of Analog Circuits and Micro Controllers & Applications

BET607: Digital Signal Processing and Digital Systems Design

BET608: Four weeks in Electronics or Telecommunication Industry

	Semester VII					
CODE	COURSE OF STUDY	L	Р	С	MSE	ESE
BET701	Digital Image Processing	4	0	8	30	70
BET702	Optical Communication	4	0	8	30	70
BET703	Elective IV	3	0	6	30	70
А	VLSI Design					
В	Electromagnetic Compatibility for Circuit Designers					
С	M.TECH. Subiect*					
BET704	Microwave Theory and Techniques	4	0	8	30	70
BET705	Computer Organization & System Software	4	0	8	30	70
BET706	Communication Engineering Laboratory VI**	0	4	4	50	50
BET707	Communication Engineering Laboratory VII***	0	4	4	50	50
BET708	Industrial Training Seminar ****	0	0	4	50	
BET709 Project		0	4	4	50	
		19	12	54	350	450
Semester VIII						
CODE	COURSE OF STUDY	L	Р	С	MSE	ESE
BET801	Satellite Communication Systems	4	0	8	30	70
BET802	Computer Networks	4	0	8	30	70
BET803	Elective V	3	0	6	30	70
А	Biomedical Electronics					
В	Adaptive Signal Processing					
С	M.Tech. Subject [#]					
BET804	Embedded Systems Design	4	0	8	30	70
BET805	Communication Engineering Laboratory VIII##	0	4	4	30	70
BET806	Communication Engineering Laboratory IX ^{###}	0	4	4	50	50
BET807	Project	0	4	12	50	50
BET808	Community Project	0	2	4	50	0
		15	14	54	300	450

*BET705C: Students opting M.Tech. Course as elective will be awarded additional 4 Credits

**BET706: Practical of Advanced Antenna Theory, Microwave Theory & Techniques and Digital Communication

- ***BET707: Practical of Digital Image Processing and Optical Communication
- ****BET708: Evaluation of four weeks Industrial Training
- #BET803C: Students opting M.Tech. Course as elective will be awarded additional 4 Credits
- ##BET805: Practical of VLSI Design, Embedded system Design and Biomedical Electronics
- ###BET806: Practical of Computer Networks and Computer Organization & System Software

BH101

Basic Course in Communicative English

6 Credits

UNIT - 1

Communication:

An introduction - Its role and importance in the corporate world - Tools of communication - Barriers - Levels of communication

UNIT - 2

Listening:

Importance to listening in the corporate world - Listening process and practice - Exposure to recorded and structured talks, class room lectures - Problems in comprehension and retention -Note-taking practice - Listening tests

UNIT - 3

Reading-1:

Introduction of different kinds of materials: technical and non-technical - Different reading strategies: skimming, scanning, inferring, predicting and responding to content

Reading-2:

Guessing from context - Note making - Vocabulary extension

UNIT - 5

Speaking:

Barriers to speaking - Building confidence and fluency - dialogue practice - Extempore speech practice - Speech assessment

UNIT - 6

Writing:

Effective writing practice - Effective sentences: role of acceptability, appropriateness, brevity and clarity in writing - Cohesive writing practice - Paragraph writing - Discourse writing

Text Books

1. Meenakshi Raman and Sangeetha Sharma, *Technical Communication*, Oxford University Press, New Delhi, 2008

Reference Books

- 1. M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw-Hill, New Delhi, 2005
- **2.** Golding S.R, Common *Errors in English Language*, Macmillan, 1978
- **3.** Christopher Turk, *Effective Speaking*, E and FN Spon, London, 1985

BH102Engineering Mathematics - I8	8 Credits
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UNIT - 1

Linear Algebra - Matrices:

Matrix operations, cofactors, normal form of a matrix, rank, Consistency, Eigen and Eigen values, Cayley – Hamilton theorem

UNIT - 2

Differential Calculus:

Successive differentiation, Leibnitz's theorem, Taylor's theorem, Maclaurin's Theorem

UNIT - 3

Vector Calculus:

Differentiation of vectors, Curves in space, Velocity and acceleration, Tangential and normal acceleration

UNIT - 4

Applications of Vector and Scalar Point Functions:

Vector operator Del, Del applied to the Scalar point function – Gradient, Del applied to the Vector point functions, Divergence and Curl, Del applied twice to point function, Line Integral, Surface integral, Volume integral, Divergence theorem, Green's theorem, Stoke's theorem.

UNIT - 5

Integral Calculus:

Double integral, Triple integral, Application to the area, volume, surface area, Moment of Inertia, Center of gravity

UNIT - 6

Infinite Series:

Positive term series - Integral test, Comparison test, D'Alembert ratio test, Cauchy's root test,

Raabe's test, Log Test, Alternating Series – Leibnitz rule, absolute and conditional convergence, power series

Text Books

- 1. Grewal B. S., Higher Engineering Mathematics, Khanna Publication, New Delhi
- 2. Kreyszig E., Advanced Engineering Mathematics, Wiley Eastern Publication

BH103	Engineering Physics - I	8 Credits
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UNIT - 1

Wave and Oscillations:

Free oscillation, damped oscillation and forced oscillation and resonance. Examples, Longitudinal and transverse wave, wave equation

UNIT - 2

Acoustics:

Ultrasonic waves piezoelectric effect, Magnetostriction effect and production of ultrasonic waves, Applications of Ultrasonic waves

UNIT - 3

Optics:

Interference in thin films, wedge shaped film and Newton's ring application of interference of light, Polarization of light, Methods for production of polarized light, Hygen's theory of double refraction, Laurent's half shade Polari meter, faraday effect, Kerr effect

UNIT - 4

Laser and Fiber Optics:

Principle of Laser, Spontaneous and stimulated emission – Einstein's co-efficient, Types of Laser and its applications , Total internal reflection, materials and types of optical fibers, numerical aperture, fiber optics communication principle and application

UNIT - 5

Electron Optics:

Motion of charged particles in electric field and magnetic field, Measurement of e/m by Thomson's Method, Millikan's Oil Drop method, Positive Rays, Bainbridge mass spectrograph

UNIT - 6

Nuclear Physics and Quantum Mechanics:

Nuclear reaction, q-value of Nuclear reaction, G. M. Counter. Duality of Matter, de-Broglie's wave, Electron Diffraction, Davisson and Germer's ē diffraction experiment, Heisenberg's Uncertainty Principle, Schrodinger's time dependent and time independent wave equation, Physical Significance of wave function

Text Books

- 1. M.N.Avadhanulu and P.G.Kshrisagar, A Text of Engineering Physics
- 2. R.K.Gaur and S.L.Gupta, *Engineering Physics*

Reference Books

- 1. D.Halliday, R.Resnick and J.Walker, Fundamental of Physics, Sixth Edition
- 2. F.S.Crawford Jr., Waves Berkeley Physics Courses, Volume 3
- 3. A.Ghatak, Optics , Third Edition

BH104Engineering Chemistry - I8 Credits

UNIT - 1

Fuels and Lubricants:

Fuels: Introduction, classification of fuel, essential properties of fuel, characteristics of good fuel, solid fuels- wood and coal, various types of coal, analysis of coal – Proximate and Ultimate analysis, liquid fuel- refining of petroleum

Lubricants: Introduction, types of lubrication, classification of lubricants, properties of lubricants

UNIT - 2

Physical Properties in Liquid State:

Additive and Constitutive properties, Surface tension and its determination, Viscosity and its determination, Refractive index and their determination, Optical activity, Specific rotation, Polari meter

UNIT - 3

Chemical Bonding:

Types of chemical bonds, Ionic bonding and its characteristics, factors affecting the fomation of ionic bond, Born-Haber cycle for determination of lattice energy, the concept of Molecular Orbital

theory, characteristics of bonding and ant bonding molecular orbitals, formation of MO, bond order and stability of molecule, energy level sequence, MO diagram of H₂, O₂, etc. Hydrogen bonding

UNIT - 4

Corrosion:

Introduction, fundamental reason, electrochemical corrosion, direct chemical corrosion, factors affecting the rate of corrosion, types of corrosion- pitting corrosion, microbiological corrosion, stress corrosion, methods to minimize the corrosion – proper design, cathodic and anodic protection, metallic coating, organic coating

UNIT - 5

Fundamentals of Organic Chemistry-1:

Introduction, E1 and E2 reactions, Birch reduction, Oppenauer oxidation, Study of Aromatic compounds: Naphthalene, Anthracene

UNIT - 6

Fundamentals of Organic Chemistry-2:

Study of Heterocyclic compound: Pyridine and Quinolene, Manufacture of alcohol by fermentation process

Text Books

- 1. Bhal and Bhal, Advanced Organic Chemistry, S. Chand and Company, New Delhi, 1995
- 2. Jain P. C. and Jain Monica, *Engineering Chemistry*, Dhanpat Rai and Sons, Delhi, 1992

Reference Books

- 1. Finar I. L., *Organic Chemistry* (Vol. I and II), Longman Gr. Ltd. and English Language Book Society, London
- 2. Barrow G.M., *Physical Chemistry*, McGraw-Hill Publication, New Delhi
- EM105

Engineering Mechanics

6 Credits

UNIT - 1

Concurrent forces in a plane:

Principles of Statics-Composition of forces-Equilibrium of concurrent forces in a plane-Method of projections- Equilibrium of three forces in a plane Method of Moments – Friction

UNIT - 2

Forces in plane:

Parallel forces in a plane: Two parallel forces- General case of parallel forces in a plane-Center of parallel forces and center of gravity-Centroids of composite plane figures and curves – Distributed forces in a plane

General case of forces in a plane: Composition of forces in a plane-Equilibrium of forces in a plane

UNIT - 3

Forces in space:

Force systems in space: Concurrent forces in space- method of projections, methods of moments-couples in space-parallel forces in space-center of parallel forces and center of gravity-general case of forces in space

UNIT - 4

Rectilinear Translation:

Kinematics of rectilinear motion-Principles of dynamics Differential equation of rectilinear motion-Motion of particle acted upon by a constant force D'Alembert's principle-Momentum and impulse-Work and energy- Ideal systems: conservation of energy- Impact

UNIT - 5

Curvilinear Translation:

kinematics of curvilinear motion- Differential equations of curvilinear motion-Motion of a projectile- D'Alembert's principle in curvilinear motion

UNIT - 6

Rigid Body Motion:

Rotation of a rigid body about a fixed axis and plane motion of a rigid body

Text Books

- **1.** Rajasekaran.S. and Sankara Subramanian.G., *Engineering Mechanics Statics and Dynamics*, Vikas Publishing Comp, 2005
- 2. S. Timoshenko and D.H. Young, Engineering Mechanics, McGraw Hill, 1995

Reference Books

- **1.** Irving H.Shames, *Engineering Mechanics Statics and Dynamics*, Pearson Educations, Forth edition, 2003
- Beer and Johnston, Vector Mechanics for Engineers, Vol.1 "Statics" and Vol.2 "Dynamics, McGraw Hill International Edition, 1995
- 3. Suhas Nitsure, Engineering Mechanics, Technical Publications, Pune, 2007

ID106	Energy and Environmental Engineering	4 Credits

UNIT - 1

Power Generation-1:

Conventional Vs Non convectional power generation, Renewable and alternative energy trends in power generation in future

UNIT - 2

Power Generation-2:

Solar, Wind, Bioenergy, Ocean Thermal energy conversion (OTEC), Tidal, Fuel cell, Magneto Hydro Dynamics (MHD)

UNIT - 3

Power Generation-3:

Thermo electric and thermionic generators – Principle and Application - Energy conservation and management- Industry, domestic, case studies

UNIT - 4

Pollution-Air:

Air pollution- sources- effects- control- air quality standards, air pollution act- measurement

UNIT - 5

Pollution-Water:

Water pollution- effects- selection of process- Disposal of solid wastes

UNIT - 6

Pollution-General:

Greenhouse effect- Acid rain- Noise pollution – Thermal pollution- Pollution aspects of various power plants

Text Books

- 1. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006
- **2.** Gilbert M. Masters, *Introduction to Environmental Engineering and Science*, 2nd Edition, Prentice Hall, 2003

Reference Books

- **1.** Rao S., Parulekar B.B., *Energy Technology-Non conventional, Renewable and Conventional,* Khanna Publishers, Delhi, 2005
- Glynn Henry J., Gary W. Heinke, *Environmental Science and Engineering*, Pearson Education, Inc, 2004

WS107	Workshop Practice	4 Credits

UNIT - 1

Carpentry/Pattern Making:

- A. Wood sizing exercises in planning, marking, sawing, chiseling and grooving to make half lap joint and cross lap joint
- B. Demonstration of power operated tools related to Carpentry skills

UNIT - 2

Fitting/Plumbing:

- A. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and Tapping on M. S. plates
- B. Demonstration on use of plumbing tools and preparation of plumbing line involving fixing of water tap and use of elbow, tee, union and coupling, etc.
- C. Demonstration of power operated tools related to Fitting skills

UNIT - 3

Sheet Metal Working:

- A. Making a small parts using GI sheet involving development, marking, cutting, bending, brazing and soldering operations- i)Tray ii) Funnel
- B. Demonstration of power operated tools related to sheet metal works

UNIT - 4

Welding:

A. Exercise in MMA welding to make a square butt joint

- B. Exercise in resistance (spot) welding to make a lap joint
- C. Demonstration of power operated tools related to Welding skills

UNIT - 5

Machine Shop:

Demonstration of step turning of a Mild Steel cylindrical job using center lathe

Instructions to the Students

Each student is required to maintain a 'workshop diary' consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job

EX108 Introduction to Electronics and Telecommunication Engineering 6 Credits

UNIT - 1

Introduction:

History of major inventions in electronics and communication Engineering, Overview of various specializations in ECE

UNIT - 2

Basics of telecommunication:

Basics of telecommunication infrastructure: Different types of channels, Bandwidth, power, range, interference, frequency reuse, fading

UNIT - 3

Industries and R& D:

Industries and R &D institutions in India

UNIT - 4

Future Scope:

Career opportunities, Avenues for higher studies in India and abroad, In plant training, Internships, Distinguished alumni in India and Abroad

UNIT - 5

Library:

Introduction to library facility in department, central library and other institutes, National and International journals, accessing digital library: Science direct and IEEE Explore, e-books and learning resources in the intranet and internet

UNIT - 6

Departmental Facilities:

Brief overview of different laboratories in ECE dept., Electronic test and measurement equipments, Energy sources, Specification for electronic components, Mini projects, Technical report preparation and presentation

Text/Reference Books

Lecture notes prepared by Department of Electronics and Telecommunication Engineering

BH201	Basic Course in Human Rights	4 Credits
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UNIT - 1

The Basic Concepts:

Individual, group, civil society, state, equality, justice, Human Values: - Humanity, virtues, compassion

UNIT - 2

Human rights and Human Duties:

Origin, civil and political rights, Contribution of American bill of rights, French revolution, Declaration of independence, Rights of citizen, Rights of working and exploited people, Fundamental rights and economic programme, India's charter of freedom.

UNIT - 3

Society, religion, culture, and their inter-relationship:

Impact of social structure on human behavior, Roll of socialization in human values, Science and Technology, modernization, globalization, and dehumanization

UNIT - 4

Social Structure and Social Problems:

Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labour, Migrant workers and human rights violations, human rights of mentally and physically challenged

UNIT - 5

State, Individual liberty, Freedom and Democracy:

The changing of state with special reference to developing countries, Concept of development under development and social action, need for collective action in developing societies and

methods of social action, NGOs and human rights in India: - Land, Water, Forest issues.

UNIT - 6

Human Rights in Indian Constitution and Law:

The constitution of India:

- (i) Preamble
- (ii) Fundamental rights.
- (iii) Directive principles of state policy.
- (iv) Fundamental duties.
- (v) Some other provisions.

Universal declaration of human rights and provisions of India, Constitution and law, National human rights commission and state human rights commission

Reference Books

- Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005
- Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India

BH202	Engineering Mathematics - II	8 Credits
	UNIT - 1	

Linear Algebra – Matrices:

Matrix operations, cofactors, normal form of a matrix, rank, Consistency, Eigen and eigen values, Cayley – Hamilton theorem

UNIT	- 2
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Differential Calculus:

Successive differentiation, Leibnitz's theorem, Taylor's theorem, Maclaurin's Theorem

UNIT - 3

Vector Calculus:

Differentiation of vectors, Curves in space, Velocity and acceleration, Tangential and normal acceleration

Applications of Vector and Scalar Point Functions:

Vector operator del, Del applied to the Scalar point function – Gradient, Del applied to the Vector point functions – Divergence and Curl, Del applied twice to point function, Line Integral, Surface integral, Volume integral, Divergence theorem, Green's theorem, Stoke's theorem

UNIT - 5

Integral Calculus:

Double integral, Triple integral, Application to the area, volume, surface area, Moment of Inertia, Center of gravity

UNIT - 6

Infinite Series:

Positive term series – Integral test, Comparison test, D'Alembert ratio test, Cauchy's root test, Raabe's test, Log Test, Alternating Series – Leibnitz rule, absolute and conditional convergence, power series

Text Books

1. Grewal B. S., Higher Engineering Mathematics, Khanna Publication, New Delhi

2. Kreyszig E., Advanced Engineering Mathematics, Wiley Eastern Publication

BH203	Engineering Physics - II	8 Credits

UNIT - 1

Crystallography and X- rays:

Crystalline and amorphous solids, crystal structure , Lattice point, space lattice, unit cells, lattice parameter and crystal systems, cubic system, number of atoms per unit cell, co-ordination number, atomic radius, packing density, Lattice constant. Lattice plane and Miller Indices, Interpalnner spacing for cubic system, Production and types of x-rays spectrum, x-ray diffraction, Bragg's law, Moseley's law

UNIT - 2

Conducing Materials:

Electrical conduction, free electron theory, Fermi Dirac statistics, band theory of solids, Resistivity of metals, Superconductivity and types- Meissner effect, High temperature superconductor, applications

Semiconductor:

Intrinsic and extrinsic semiconductor, conductivity of semiconductor and its temperature dependence, Fermi level, Hall Effect, semiconductor devices (P-N junction diode, Transistor)

Dielectric Materials:

Dielectric constant, polarization, types of polarization Internal field and claussius-Mosotti equation, types of dielectric materials, temperature and frequency effect, application.

UNIT - 5

Magnetic Materials and Advanced Materials:

Magnetic dipole moment, magnetic flux density, magnetic field strength magnetization, magnetic permeability, types of magnetic materials, domain theory, hysteresis loop, hard and soft materials, Nano materials, physical properties, a ferrites and garnets and application

UNIT - 6

Electrodynamics:

Coulomb's law for distribution of charges, polarization and Gauss's law, Maxwell's equation, electromagnetic wave equation, propagation of electromagnetic waves in free – space

Text/Reference Books

- 1. A text of Engineering Physics M. N. Avadhanulu and P. G. Kshrisagar
- 2. Materials Science and Engineering V. Raghavan

Text/Reference Books

- **1.** E. M. Purcell, Electricity and Magnetism-Berkeley Physics Course Volume 2
- **2.** J. R. Reitz, F. J. Milford and R. W. Christy, Foundation of electromagnetic theory, third edition

BH204	Engineering Chemistry - II	8 Credits
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UNIT - 1

Water:

Introduction, Hard and soft water, softening of water-zeolite process, ion-exchange process, hot limesoda process, purification of water- methods to remove suspended impurities, methods to remove germs and bacteria.

UNIT - 2

Metallurgy:

Introduction, occurrence of metals, Types of ores, conc. of ores- crushing and sizing, froth flotation, magnetic separation, tabling process etc. calcination, roasting, reduction by pyrolysis. Chemical reductions, Refining of metals

UNIT - 3

Phase Rule:

Phase Rule, statement & derivation, explanation of the terms- Phase, components, degrees of freedom, one component system-water & sulphur, two components alloy system.

UNIT - 4

High Polymers:

Introductions, Types of polymerization-addition, condensation & co-polymerization, molecular weight determination by viscosity method & osmotic pressure method, plastic and its classification

UNIT - 5

Electrochemistry – I:

Introduction, conductivity-specific conductance, equivalent conductance, measurement of conductance, cell constant, factors affecting the conductance of electrolytic solution, conductometric titrations, Debye- Huckel theory of strong electrolyte, Transport number & determination of transport number by moving boundary method

UNIT - 6

Electrochemistry – II:

Introduction, Theory of acid-base indicator, glass electrode, Quinhydrone electrode, measurement of pH, potentiometric titration

Text Books

- 1. Bhal and Bhal, Advanced Organic Chemistry, S. Chand and Company, New Delhi, 1995
- 2. Jain P. C. and Jain Monica, *Engineering Chemistry*, Dhanpat Rai and Sons, Delhi, 1992

Reference Books

- 1. I. L., Organic Chemistry (Vol. I and II), Longman Gr. Ltd. and English Language Book Society, London
- 2. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi
- 3. S. S. Dara, Engineering chemistry, S. Chand & company, New Delhi

CL205 Basic Civil Engineering	4 Credits		
UNIT - 1			
Properties and uses of Construction Materials:			
Stones, bricks, cement, concrete and steel. Site selection for buildings			

UNIT - 2

Component of Building: Foundation- Shallow and deep foundations

UNIT - 3

Brick and Stone Masonry:

Plastering- Lintels, beams and columns- Roofs

UNIT - 4

Roads:

Classification of Rural and urban Roads- Pavement Materials-Traffic signs and road marking-Traffic Signals

UNIT - 5

Surveying:

Classification-Chain Survey-Ranging-Compass Survey-exhibition of different survey equipment

UNIT - 6

Water Supply:

Quality of Water-Wastewater Treatment units-Their functional utility- Need for conservation of water

Reference Books

- **1.** Sushil Kumar (2001), *Building Construction*, Standard Publishers Distributors
- **2.** S.C Rangwala (1996), *Building Materials*, Charotar Publishing House
- **3.** Lecture notes prepared by Department of Civil Engineering

ME206	Basic Mechanical Engineering	4 Credits

UNIT - 1

Introduction	to Mechanical	Engineering:

Thermal Engineering, Design Engineering, Manufacturing Engineering

UNIT - 2

Introduction to Laws of Thermodynamics:

Simple examples pertaining to respective branches, IC Engines: Classification, Applications, 2 Stroke and 4 Stroke systems in IC Engines

UNIT - 3

Automobiles:

Transmission systems, Suspension system, Power Plant: Types of Power plant; Gas power plant, Thermal power plant, nuclear power plant

UNIT - 4

Design Basics: Mechanisms, Factor of safety, materials and metallurgical considerations

UNIT - 5

Engineering Materials, Machine Elements, Transmission, Fasteners, Support Systems

UNIT - 6

Manufacturing:

Classification, introduction to Lathe machine, Drilling machine, Milling machine, metal joining, Metal forming, casting (A visit to Workshop for demonstration)

Text/Reference Books

1. Lecture notes prepared by Department of Mechanical Engineering

Drawing standard:

ME207

Drawing standard SP46: Dimensioning, Lettering, type of lines, scaling conventions

UNIT - 2 Geometrical Constructions:

Dividing a given straight line into any number of equal parts, bisecting a given angle, drawing a regular polygon given one side, special methods of constructing a pentagon and a hexagon

UNIT - 3

Orthographic /Isometric Projection:

Introduction to orthographic projection, drawing orthographic views of objects from their isometric views - Orthographic projections of Points lying in four quarters, Orthographic projection of lines parallel and inclined to one or both planes. Orthographic projection of planes inclined to one or both planes. Isometric Projection and view of planes and simple solids

UNIT - 4

Solids and Sectioning:

Types of solids, Projections of solids with axis perpendicular to HP, solids with axis perpendicular to VP, solids with axis inclined to one plane. Projection of spheres touching each other sectioning of solids: section planes perpendicular to one plane and parallel or inclined to other plane

UNIT - 5

Studies of Surfaces:

Intersection of surfaces: intersection of cylinder and cylinder, intersection of cylinder and cone, intersection of prisms. Development of surfaces: Development of cylindrical and conical surfaces Development of prisms.

UNIT - 6

Computer Aids:

Introduction to computer aided drafting: introduction to computer aided drafting package to make drawings

Text Books

6 Credits

Engineering Graphics

- 1. N.D. Bhatt, *Engineering Drawing*, Charotar publishing House, 46th Edition, 2003
- 2. K.V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006

Reference Books

1. K. Venugopal and V. Prabhu Raja, *Engineering Graphics*, New Age International (P) Ltd, 2008

EX208 Electronics and Tele-Communication Engineering: Programming and Software 6Credits

UNIT - 1

Introduction to MATLAB:

MATLAB and Its family, Menus and toolbars, Types of windows and types of files, MATLAB Help system, Basic calculations in MATLAB, Vectors and arrays, Multi-dimensional arrays, Element by element operations, Polynomial operations using arrays , X-Y Plotting functions, Subplots, 3-D Plots and Contour plots

UNIT - 2

Functions and Files and Programming Techniques:

Elementary mathematical functions, User defined functions, working with input and output files, Program design and development, Relation and Logical Operators, Conditional statements, Loops and switch structure

UNIT - 3

Introduction to Polymath:

Equation solvers available with polymath, plotting with polymath

UNIT - 4

Introduction to FEMLAB

Overview of FEMLAB application modes, creating and opening models, modeling using GUI, Time dependent simulation, solving differential equations and logical functions, Electromagnetic Waves modeling

UNIT - 5

Introduction to Office Automation:

Word processor (Ms Office) and LaTeX, Spread sheet (Ms Excel)

UNIT - 6

Introduction to Simulation Softwares

Introduction to Webpack, Modelsim, Micro-wind, Proteus, Multisim, Compiler, Assembler, Debugger, Emulator, Workbench, Optisim, Com-sim, IE3D, Mathematica, Universal Programmer

Hand on Experience

- **a)** Five programs using MATLAB (Program will be on Basic Calculation, Calling Data file and sending results to Data file, Control structure, Plots and Subplots, creating and using built in functions) (5 Program Submissions)
- **b)** Solving differential equation using polymath (One)
- **c)** Simple models using FEMLAB (Three)
- d) Journal Paper will be created using Ms Word and using LaTeX each. (Two)
- **e)** One exercise using Ms Excel (One)

Text Books

Getting started with MATLAB: A quick introduction for scientists and engineers' by Rudra Pratap, Oxford University press, 2003

Reference Books

- 1. Introduction to MATLAB 7 for Engineers, by W. L. Palm III, McGraw Hill ,2005
- **2.** FEMLAB user manual
- **3.** Polymath user manual (Freely downloadable from Polymath official website)
- 4. User manuals for each of the software's in unit VI

UNIT - 1

Series of number, Improper integrals, Cauchy criterion, Test of convergence, Absolute and conditional

Fourier series

Infinite Series:

Half-range expansions, Approximation by trigonometric polynomials, Fourier integrals

convergence, Series of functions, Uniform convergence, Power series, Radius of convergence

UNIT - 3

Partial Differential Equations

First and second order Liner Partial Differential Equations with variable coefficients, Wave equation and heat equation in one and two dimensions, Laplace equation in two and three dimensions (Cartesian co-ordinates only), Transforms techniques in Ordinary Differential Equations and Partial **Differential Equations**

UNIT - 4

Power Series Methods for Solution of Ordinary Differential Equations

Legendre equations and Legendre polynomials, Bessel functions of first and second kind, Orthogonality, Strum- Liouville problems

UNIT - 5

Laplace transforms

Laplace transforms of various functions

UNIT - 6

Inverse transforms

Shifting on the s and t axes, Convolutions, Partial fractions

TEXT/REFERENCE BOOKS

1. J.N. Wartikar and P.N. Wartikar, "Engineering Mathematics Vol. I and Vol. II, Pune

2. VidyarthiGriha Prakashan", Pune, 1984, 9th Edition

UNIT - 2

8 Credits

Engineering Mathematics-III

BET301

- 3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publication, New Delhi. 1990, 22nd Edition
- 4. E. Kreyszig, "Advanced Engineering Mathematics", John Wiley Eastern, New York, 1999, 9th Edition
- 5. Peter V, O'Neil, "Advanced Engineering Mathematics, PWS", Bosten, 1991, 3rd Edition

BET302	Electronics Devices and Circuits-I	8 Credits

UNIT - 1

Semiconductor Physics and Materials

Intrinsic and extrinsic semiconductors, Conduction mechanism in extrinsic semiconductors, Carrier concentrations, Drift and diffusion mechanisms, Drift and diffusion current densities, Excess carriers, Recombination process, Mean carrier lifetime, Conductivity, Mobility, Mass action law, Einstein relationship, Semiconductor materials used in opto-electronic devices - GaAs, Si, Ge, GaAsP

UNIT - 2

Semiconductor Diodes

A brief overview of following types of diodes -Rectifier, Signal, Switching, Power, Tunnel, Shockley, Gunn, PIN, Zener diode, Semiconductor P-N junction diode -Metallurgical junctions and Ohmic contacts, Depletion region, Barrier potential, forward and reverse biased diode operation, V-I characteristic equation of diode, Temperature dependence of V-I characteristics, DC load line. Forward and reverse dynamic resistance, Small signal and large signal diode models. Diode specifications, switching diodes - Diode switching times, junction capacitances, Breakdown Mechanisms in Semi-Conductor (Avalanche and Zener breakdown) Diodes

UNIT - 3

Field Effect Transistors

An overview of different types of FETs viz. IFET, MOSFET, MESFET, IFET: IFET construction, Symbol, Basic operation, V-I Characteristics, Transfer Characteristics (Shockley's Equation), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance. Drain to Source resistance, Universal JFET bias curve. Biasing arrangements for JFET - Biasing against device variation, biasing for zero current drift. JFET as voltage controlled current source, JFET specifications, JFET Amplifiers: CS, CD, CG amplifiers, their analysis using small signal JFET model

UNIT - 4

MOSFETs

An overview of following MOSFET types - D-MOSFET, E-MOSFET, Power MOSFET. N- MOS, p-MOS and CMOS devices, Handling precautions for CMOS devices, D and E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub

threshold conduction, breakdown effects and temperature effects, MOSFET Biasing, Introduction to MOSFET as VLSI device

UNIT - 5

Bipolar Junction Transistor

An overview of different types of BJTs - Small signal and large signal low frequency types, Switching/RF, Heterojunction types, BJT Biasing and basic amplifier configurations: Need for biasing BJT, DC analysis of BJT circuits, Q point, typical junction voltages for cutoff, active and saturation regions, voltage divider bias and its analysis for stability factors, Small signal low frequency h-parameter model, Variation of h-parameters with operating point. Derivations for CE configuration for AI, Ri, Ro, Avs, AIS in terms of h-parameters, Comparison of performance parameters with CB and CC configurations, Need for multistage amplifiers and suitability of CE, CC and CB configurations in multistage amplifiers

UNIT - 6

Evaluation of Amplifiers

Concept of frequency response, Human ear response to audio frequencies, significance of Octaves and Decades, The decibel unit, Square wave testing of amplifiers, Miller's theorem, Effect of coupling, bypass, junction and stray capacitances on frequency response for BJT and FET amplifiers, Concept of dominant pole, N stage cascade amplifier, band pass of cascaded stages

TEXT/REFERENCE BOOKS

- 1. Electronic devices and circuits theory, Boylestead Nashelsky
- 2. Electronic Devices, Thomas L. Floyd, Pearson Education-Sixth edition
- 3. Electronic circuit analysis & Design, Donald A. Neamen, Tata McGraw Hill –Second Edition
- 4. Electronic Device & Circuits, Millman Halkies, Tata McGraw Hill
- 5. Microelectronics, Second edition, Millman Grabel, Tata McGraw Hill

BET303	Digital Electronics	8 Credits

UNIT - 1

Number System and Coding Techniques

Number systems: Binary, Decimal, Octal and Hexadecimal, Conversion methods, Binary addition and subtraction, 1's and 2's complement of binary number, Concept of coding, BCD code, Excess-3 code, Gray code, ASCII code, Error detecting and correcting codes

Logic Gates and Boolean algebra

Logic gates: Inverter, AND, OR, NAND, NOR, Exclusive-OR and Exclusive-NOR, Boolean operations and expressions, De-Morgan's theorems, Simplification using Boolean algebra, Standard forms of Boolean expressions, Karnaugh map up to 6 variables, Don't care conditions, Quine Mc-Clusky method up to 4 variables

UNIT - 3

Combinational Logic Circuit

Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractors, look ahead carry, ALU, Digital Comparator, Parity, generators /checkers, Static and dynamic hazards for combinational logic.Multiplexers and their use in combinational logic designs, multiplexer trees, Demultiplexers and their use in combinational logic designs, demultiplexer trees, , Decoders , Encoder

UNIT - 4

Sequential Logic Circuit

Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops, Excitation Table for flip flops. Conversion of flip flops, Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), ripple counters, up/down counters, synchronous counters

UNIT - 5

Semiconductor Memories, ADC/ DAC & Logic Families

RAM, ROM, PROM, EPROM, EEPROM, SRAM, DRAM, Concept of PLA and PAL. Sample and hold circuits, DAC: the weighted resistor DAC, R-2R ladder network, ADC: Successive approximation, Dual slope, Integrator type and flash ADC

UNIT - 6

Digital Logic Families

Classification of logic families , Characteristics of digital ICs-Speed of operation , power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL-operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic, CMOS logic - CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output, Interfacing CMOS and TTL, Comparison table of Characteristics of TTL, CMOS, ECL, RTL, I2L, DCTL

TEXT/REFERENCE BOOKS

- 1. M. Marris Mano, Digital Logic and Computer Design, PHI, New Delhi, 2001
- 2. W. H. Gothman, Digital Electronics Theory and Practice, PHI, New Delhi, 2002, 2nd Edition
- 3. Malvino and Leach, Digital Principles and Application, TMH, New Delhi, 1995, 4th Edition

4. Wakerly Pearon, "Digital Design: Principles and Practices", 3rd edition, Pearon Education, 2004

EE304 Network Analysis	8 Credits
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UNIT - 1

Active and passive circuit elements

Independent & dependent voltage & current sources, R. L, C & mutual inductance circuit parameters, their mathematical modes, Voltage current power relations. Classification of elements: Lumped distributed, Linear & non-linear, Unilateral, Bilateral, time invariant & variant, Phase invariant & variant

UNIT - 2

Network Equations

Network topology, Graph, Tree, Branches, Chords, Equilibrium equations on loop basis & node basis, Number of Network equation required, choice between nodal & loop analysis, Source transformation, Network mutual inductance, Dot conventions, Concept of Super mesh, Super node concept of duality & dual networks

UNIT - 3

Solution of Network Equations

Classification solution of first, second order differential equations of series & parallel R-L, R-C, R-L-C circuits, General & particular solutions, Particular integral & complimentary functions, Time constant, Mathematical analysis of circuit transients, Initial conditions in network, Procedure of evaluality, Conditions in network problems, Solution of DC resistive network & AC sinusoidal steady state networks, Writing loop equations, Node equations directly in matrices form, Numerical

UNIT - 4

Application of Laplace's Transform

Solution of differential equation using Laplace transform, Unit step, impulse & ramp functions, Laplace transform of singular & shifted function, Convolution integral, Concept of complex frequency, Transform impedance & transform admittance, Series & parallel combination of these transform networks

UNIT - 5

Network Theorems

Super position, Thevenin's, Norton's reciprocity, Maximum power transfer, Substitution, Tellegen's theorem, Terminals & Terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeros, Two port networks, Z, Y & the transmission parameters relationship between parameter set

UNIT - 6

Sinusoidal Steady State AC Circuit

R-L-C series circuits, Series resonance variations of Z with frequency, Maximum value of VC & VL, Magnification, Bandwidth, O-factor Parallel Resonance: Resonance frequency for tank circuit, Locus diagram of series R-L, R-C with variable R & X, Filter: Introduction, Classification, Low pass, High pass, Band pass & Band reject filter, Active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms

TEXT/REFERENCE BOOKS

- 1. Van Valcanburg, "Network Analysis", Tata McGraw Hill
- 2. Scolt, "Network Analysis, Volume- I, II & III"
- 3. C. L. Wadhwa, "Network Analysis", New Age International Publication

BET305 Numerical Methods and Computer Programming

UNIT - 1

Introduction to Computational Methods and Errors:

Computational Methods: General principles of computational techniques, Introduction, common ideas and concepts of computational methods, various computational techniques. Errors: Types and sources of errors, Concept in error estimation, Error propagation, Error due to floating point, Representation of errors. Elementary uses of series in calculation of errors

UNIT - 2

Solution of Transcendental / Polynomial Equations and System of Linear Equation

Solution of Transcendental / Polynomial Equations: Finding root of polynomial equations deploying computational methods such as Bisection, Regula-falsi, Newton-Raphson, Seccant, Successive approximation. System of linear equation: Solving linear equations deploying computational methods such as Gauss elimination. Gauss Jordan. Partial pivoting. Matrix triangularisation (LU decomposition). Cholesky, Gauss Seidel and Jacobi methods

UNIT - 3

Interpolation and Polynomial Approximation

Least square approximation, Orthogonal polynomials Chebyshev polynomials, Finite difference operator and their relations, Forward, backward, central and divided difference, Newton's forward divided difference, Backward difference interpolation, Sterling interpolation, Lagrange's interpolation polynomials, Spline interpolation, Least square approximation

8 Credits

UNIT - 4

Numerical Integration and Differentiation

Numerical Integration: Methods based on interpolation such as Trapezoidal rule, Simsons 1/3 and 3/8 rules.

Numerical differentiation: Euler's method, Modified Euler's method, Taylor's series, Runge Kutta 2nd and 4th order, Stability analysis of above methods

UNIT - 5

Object Oriented Programming:

Software Evaluation, Object oriented programming paradigm, Basic concepts of object oriented programming, Benefits of OOP, Object oriented languages, Applications of OOP

Beginning with C++:

Structure of C++ program, Creating the source file, Compiling & linking, Basic data types, User defined data types, Symbolic constants, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Type cast operator

Functions in C++:

Function prototyping, Inline functions, Function overloading, Friend and virtual functions

Classes and Objects:

Specifying a class, Defining member functions, C++ program with class, Arrays within a class, Memory allocation for objects, Constructors, Multiple constructor in class, Dynamic initialization of objects, Dynamic constructor, Destructors

UNIT - 6

Operator Overloading and Type Conversions:

Defining operator overloading, Overloading unary operators, Overloading binary operators, Manipulation of strings operators, Rules for overloading operators.

Inheritance: Extending Classes:

Defining derived classes, Single inheritance, multilevel inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Member classes: Nesting of classes

Pointers Virtual Functions and Polymorphism:

Pointers to objects, Pointers to derived classes, Virtual functions, pure virtual functions

Managing Console I/O Operations

C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Managing output with manipulators

TEXT/REFERENCE BOOKS

- 1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI, 1990, 3rd edition
- 2. V. Rajaraman, "Computer Oriented Numerical Methods, PHI, New Delhi", 2000, 3rd Edition
- **3.** E. V. Krishnamurthy, and Sen S. K., "Numerical Algorithm : Computations in Science and Engg", Affiliated East West, New Delhi, 1996

- 4. D. Ravichandran, "Programming with C++", TMH
- 5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi, 2001,2nd Edition
- 6. Yeshwant Kanetkar, "Let us C++, BPB Pub.", Delhi, 2002, 4th Edition
- 7. Stroupstrup Bjarne, "C++ Programming Language", Addison Wesley, 1997, 3rd Edition Horton,

"Beginning C++: The Complete Language", Shroff Pub., Navi Mumbai, 1998

BET306	Electrical Technology	8 Credits

UNIT - 1

DC Circuits

Direct current and voltages, ohms law, series and parallel arrangement current division, Kirchhoff's laws, batteries, principle of operation and applications

UNIT - 2

AC circuits

Alternating current and voltage, circuit elements R, L&C, Phasor diagram, concept of impedance and admittance, real and reactive power in single phase circuits

UNIT - 3

Introduction to Machine Theory

Role of electrical Machine, Convergence process in a machine, Magnetic field energy, Analysis of force of alignment, Rotary motion (rotary magnetic field)

UNIT - 4

A C Machine: (Transformer and Induction motor)

Single phase transformer construction, principle of operation, introduction to three phase system and applications, Construction, principle of operation, significant characteristics, starting methods and applications of Three Phase and single phase Induction motors

UNIT - 5

DC Machines

DC GENERATORS: Principle of operation, Construction EMF equation, Types of generators, Armature reaction, Commutation, Characteristic of series, Shunt and compound generators, Efficiency calculations and applications

DC Motors

DC machine as a generator or motor, Significance of back emf, significant characteristics, Speed control, Different types of starters and its applications

TEXT/REFERENCE BOOKS

- 1. Nagrath and Kothari, "Electrical Machines", TMH, 1996
- 2. H. Cotton, "DC Machines", Wheelers, 1995
- **3.** P.S. Bhimra, "Electrical Machines", TMH
- **4.** Hughes revised by McKenzie smith with John Hilcy and keith Brown, Electrical and Electronics technology, 8TH edition, Pearson, 2006
- 5. B L Theraja ,S Chand & Co, Fundamentals of Electrical Engineering and Electronics 2007 Vincent Del Toro, Electrical Engineering Fundamental, Prentice Hall India, 2002

BET307	Seminar Report and Presentation	4 Credits
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A student has to undertake a seminar topic based on his/her choice.

A Self-study report on the selected topic has to be prepared under the supervision of the guide. MSE will be conducted to evaluate the preparation.

BET401	Microprocessor	8 Credits
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UNIT - 1	
Architecture of Microprocessors: General definitions of Mini Computers, Microprocessors Processors, Overview of 8085 Microprocessor, Overview of 8 8086 Microprocessor	, Microcontrollers and Digital Signal 086 Microprocessor, Signals and pins of

Assembly language of 8086:

Description of Instructions, Assembly directives, Assembly software programs with algorithms

UNIT - 3

Interfacing with 8086

Interfacing with RAMs, ROMs along with the explanation of timing diagrams, interfacing with peripheral ICs like 8255, 8254, 8279, 8259, 8259 etc, interfacing with key boards, LEDs, LCDs, ADCs, and DACs etc

UNIT - 4

Coprocessor 8087

Architecture of 8087, Interfacing with 8086, Data types, Instructions and Programming

UNIT - 5

High end processors

Introduction to 80386 and 80486

UNIT - 6

UNIT VI Introduction to Pentium and its higher generations:

Architecture, Memory Management, Assembler, Debugger, Introduction to bit Slice Processor, Signal Processing Processor and Transputers, Introduction to development tools, MDS, Logic Analyzer, and in-circuit emulator

TEXT/REFERENCE BOOKS

- **1.** R. S. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Pen Ram International, 3rd Edition
- Liu, Gibson, "Microcomputer System: The 8086/88 Family Architecture, Program Design", PHI, New Delhi, 1996, 2nd edition
- **3.** Douglas Hall, "Microprocessor Interfacing: Programming and Hardware", TMH, Illinois, 1991, 2nd Edition
- 4. Walter Triebel, Avtar Singh, "The 8088 & 8086 microprocessors", PHI, 4th edition
- 5. Barry B. Brey, "The Intel Microprocessor", Pearson education, 6th edition

BET402	Electronics Devices and Circuits-II	8 Credits

UNIT - 1

Diode Applications: Voltage multiplier circuits: Working and comparison of voltage doubler, tripler and voltage quadrupler configurations, Limitations of voltage multiplier circuits, Effect of frequency on load regulation, Clipping and clamping circuits: Series and parallel forms of clipping circuits, Biased clipper, their operation and transfer characteristics, Clamping circuits

MOSFET Applications: MOSFET in VLSI: V-I characteristic equation in terms of W/L ratio, MOSFET scaling and small geometry effects, and MOSFET capacitances, Modeling MOS transistors using SPICE.

CMOS inverter, Static characteristics - Noise margin, threshold voltage, Layout and latch-up prevention, other logic gates-NAND and NOR gates

UNIT - 2

Power MOSFET: Construction- Lateral double diffused MOSFET, VMOSFET. Drive requirements, Comparison with power BJT, one example of drive circuit for POWER MOSFET.

POWER BJT: Power BJT construction, Data sheet specifications, Thermal resistance, Second breakdown, Safe operating area (SOA), Thermal runaway, BJT as a switch in display and relay drive applications, Drive considerations, Antisaturation circuits, Comparison with POWER MOSFET

UNIT - 3

Large signal AF BJT amplifiers: Block schematic of AF amplifier, Classes of power amplifiers n overview and applications of Class C and Class D amplifiers. Class A with resistive load, Transformer coupled class A amplifier, Class B Push-pull, Class AB, Complementary symmetry and Quasi-complementary configurations. Efficiency analyses for Class A transformer coupled amplifier, Class B push-Pull amplifiers, Comparison of efficiencies of other configurations, Distortions in amplifiers, concept of Total Harmonic Distortion (THD).

UNIT - 4

High frequency, small signal BJT amplifiers: Behavior of transistor at high frequencies, Modified T equivalent circuit, High frequency hybrid O CE amplifier model, CE short circuit current gains for T and hybrid models, Definitions and derivations for fa, fb and fT, Amplifier bandwidth considering source and load resistances, Techniques to improve bandwidth, Single tuned, Double tuned and stagger tuned amplifiers, Effect of staggering on bandwidth

UNIT - 5

Feedback Amplifiers And Oscillators: Concept of feedback, Negative and positive feedback. Classification of amplifiers based on feedback topology, Transfer gain with feedback. Advantaged and disadvantages of negative feedback, Effect of feedback on input and output impedances and bandwidth of an amplifier, Analysis of one circuit for each feedback topology

OSCILLATORS: Oscillator startup mechanism, need for amplitude limiting. Study of LC oscillators - General form of LC oscillator, Hartley oscillator, Colpitts oscillator, Clapp oscillator, Crystal oscillator, Crystal clock

UNIT - 6

Linear Voltage Regulators And Voltage References: Block schematic of linear regulators, Emitter follower regulator, Transistor series regulator and its analysis for performance parameters, 3 terminal floating, dual and adjustable regulators. Method of boosting output current using external series pass transistor, Performance parameters - Load and Line regulation, Ripple rejection, Output resistance and efficiency, Protection circuits - Reverse polarity protection, over current, fold back current

limiting, over voltage protections, Important data sheet specifications of linear regulators, Voltage references, their peculiarities and applications

TEXT/REFERENCE BOOKS

- Electronic devices and circuits theory, Boylestead & Nashelsky Pearson/Prentice Hall, 9th Edition, 2006
- 2. Electronic Devices, Thomas L. Floyd, Pearson Education- Sixth edition
- 3. Electronic circuit analysis & Design, Donald A. Neamen, Tata McGraw Hill -Second Edition
- 4. Microelectronic Circuits & Devices, Mark N. Horenstein, Prentice Hall- Second Edition
- 5. Electronic Device & Circuits, Millman Halkies, Tata McGraw Hill-2nd edition-2007
- 6. Switched mode power supplies Chryssis
- 7. Electronic Devices and Circuits, David A. Bell, PHI, New Delhi, 2002, 3rd edition

RFT403	Signals and Systems

8 Credits

UNIT - 1

An introduction to signals and systems

Signals and systems as seen in everyday life, and in various branches of engineering and science electrical, mechanical, hydraulic, thermal, biomedical signals and systems as examples. Extracting the common essence and requirements of signal and system analysis from these examples

Formalizing signals

Energy and power signals, signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals.

Formalizing systems

System properties: linearity: Additivity and Homogeneity, Shift- invariance, Causality, Stability, Realizability, Examples

UNIT - 2

Time Domain Representation of Analog and Digital Linear Time Invariant Systems (CT and DT LTI):

The Sampling Theorem and its implications, Spectra of sampled signals, Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on, Aliasing and its effect, Relation between continuous and discrete time systems Continuous time and discrete time linear shift-invariant (LSI) systems in detail: the impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections, Characterization of causality and stability of
linear shift- invariant systems, System representation through differential equations and difference equations

UNIT - 3

Fourier Representation of CT and DT Signals:

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, Convolution/ multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT), Parseval's Theorem, The idea of signal space and orthogonal bases of signals

UNIT - 4

The Laplace Transform for continuous time signals and systems

The notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. Generalization of Parseval's Theorem

UNIT - 5

The z-Transform for discrete time signals and systems

Eigen functions, region of convergence, system functions, poles and zeros of systems and sequences, zdomain analysis. Generalization of Parseval's Theorem System realization through block-diagram representation and system interconnection, State- space analysis and multi-input, multi-output representation, the state-transition matrix and its role

UNIT - 6

Applications of signal and system theory

Modulation for communication, filtering and so on, advanced topics: time-frequency representation and the uncertainty principle, Short-time Fourier Transforms and wavelet transforms

TEXT/REFERENCE BOOKS

- 1. Oppenhein, Willsky and Nawab, "Signals and Systems", PHI, 2003, 3rd edition
- 2. Ziemer, "Signals and Systems, Continuous and Discrete", Macmillan
- 3. Hsu, "Signals and Systems", TMH
- 4. Taylor, "Principles of Signals and Systems", McGraw-Hill, New York, 1994

BET404

Principles of Communication

8 Credits

Introduction to Communication Systems

Introduction to transmitter, the dB in communications, noise, noise designation & calculation, noise measurement, concept of modulation, Bandwidth requirement, Frequency allocation, Noise in modulation systems, Introduction to random processes and random signals as applicable to noise

UNIT - 2

Linear Modulation

Amplitude modulation, DSB-SC modulation, Generation of AM and DSB-SC signals, Envelope detector, Theory of single sideband, Generation of SSB signals, Demodulation of SSB, Vestigial Side Band (VSB) Modulation, Envelope detection of VSB+C, Superheterodyne Receiver

UNIT - 3

Angle Modulation

Introduction, Bandwidth of FM, Tone Modulation, Phase Modulation, Generation of FM, Demodulation of FM, Band pass Linear (BPL), Broadcast FM

UNIT - 4

Digital Transmission of Analog Signals: PCM, DPCM AND DM

Introduction, The PCM system, Sampling, Quantization, Encoding, Electrical waveform representation of binary sequences, Bandwidth requirements of PCM, Differential Pulse Code Modulation (DPCM), Delta Modulation

UNIT - 5

Noise Performance of Various Modulation Schemes

Introduction, Receiver Model and Figure of Merit: Linear Modulation, Coherent Demodulation, Envelope Detection, Receiver Model: Angle Modulation, Calculation FOM, Pre-Emphasis and de-Emphasis in FM, Noise performance of a PCM system

UNIT - 6

Communication Techniques

Introduction, Frequency conversion, Special techniques, receiver noise & sensitivity, dynamic range, Intermodulation distortion testing, Frequency synthesis, directs digital synthesis, FM communications transceivers. Review of telegraphy, Telephony and telemetry. Microphones and Loudspeakers: Concept, classifications & working. PA system

TEXT/REFERENCE BOOKS

- 1. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8th Edition
- 2. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5th Edition

- 3. Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4th Edition
- 4. R.G.Gupta, "Audio & Video Systems" Tata McGraw-Hill New Delhi-2008

BET405A	Elective-I: Linear Algebra	6 Credits

Linear Equations

Systems of linear equations, Matrices, Elementary row operations, Row-reduced echelon matrices

UNIT - 2

Vector Spaces

Groups, Fields, Rings, Vector spaces, Subspaces, Bases and dimension, ordered bases and coordinates

UNIT - 3

Linear Transformations

Linear transformations, Rank-nullity theorem, Algebra of linear transformations, Isomorphism, Matrix representation, linear functionals, Annihilator, Double dual, Transpose of a linear transformation

UNIT - 4

Elementary Canonical Forms:

Characteristic values and characteristic vectors of linear transformations, Diagonalizability, Minimal polynomial of a linear transformation, Cayley- Hamilton theorem, Invariant subspaces, Direct-sum decompositions, Invariant direct sums, The primary decomposition theorem, Cyclic subspaces and annihilators, Cyclic decomposition, Rational, Jordan forms

UNIT - 5

Inner Product Spaces

Inner product spaces, Orthonormal bases, Gram-Schmidt process, Linear Functional and Adjoints, Unitary Operators, normal Operators

UNIT - 6

Bilinear Forms

Bilinear Forms, Symmetric Bilinear Forms, Skew Symmetric Bilinear Forms

TEXT/REFERENCE BOOKS

1. K. Hoffman and R. Kunze, Linear Algebra, 2nd Edition, Prentice-Hall of India, 2005

2. M. Artin, "Algebra", Prentice-Hall of India, 2005

BET405B

Elective-I: Electronic Measurements and Instruments

6 Credits

UNIT - 1

Introduction

Accuracy, Resolution, Precision, Linearity of measuring instruments, Voltage, Current, Resistance, Measurement using DMM- 4 1/2 & 6 V**2**, Auto zero, Auto ranging. True RMS Measurement Principle, method & application, Phase and Magnitude Measurement at high frequency using instruments such as vector voltmeter and vector impedance meter, LCR-Q meter - principle of digital LCR-Q meter, Important specification & Application

UNIT - 2

Standards

Standards - Primary, secondary, working. Need of calibration, Procedure, Traceability & It's requirements, Statistical Analysis - Mean, Mode, Deviation, Variance & Probability for error finding. Regression Analysis, Various methods & it's advantages, Time, Frequency, Ratio, Time interval, Period & Multiple Period averaging using digital universal frequency counter, High frequency measurements on frequency counter using various techniques, such as pre-scalar, Heterodyne, Time standards - Stability using oscillators like TCXO, OCXO

UNIT - 3

Oscilloscopes

Overview of analog CRO, dual/ Multi-trace CRO, Block diagram, functioning, specifications & Applications, Various CRO probes & its applications. Digital Storage Oscilloscope - Block Diagram, Functioning, specifications & Applications, Advantages as compared to analog CRO, Sampling speed & Memory depth of DSO, Design considerations, Attachments to DSO for enhancing the functionality / Measurements such as FFT, MATHS Functions, Automatic Measurements

UNIT - 4

Analyzers

Signal Analyzing instrument, harmonic and wave analyzer, distortion factor meter spectrum analyzer - FFT analyzer, logic analyzer, Protocol analyzer, for all above mentioned instruments, explanation of block diagram with function of each block, important specification and applications of each

UNIT - 5

Communication Measurements

Communication measurements, Measurements on transmitter and receiver: sensitivity, selectivity, phase jitter, s/n ratio, co-channel interference, SINAD test etc. Network analyzer- system element,

measurement accuracy, scalar network analyzer, vector network analyzer, S- parameter measurement using network analyzer

UNIT - 6

Computer controlled test measurements, Virtual measurements and its application in TDM, FDM, ASK, PSK, IEEE 488, PCI/PCI express, buses, Introduction of Lab view

TEXT/REFERENCE BOOKS

- **1.** A. J. Bowon, "Digital Communication".
- 2. Oliver Cage, "Electric Instrumentation", Tata McGraw Hill
- 3. H. S. Kalsi, "Digital Instrumentation", Tata McGraw Hill
- Coombs "Electronic Instrumentation Handbook" 4.
- Cooper Herfric, "Electric Instrumentation & Measurement Techniques", PHII 5.
- 6. J. J. Carr, "Digital Instrumentation"
- 7. M. M. S. Anand, "Electric Instrument & Instrumentation Techniques"

BET405C	Industrial Instrumentation	6 Credits

Introduction

Basic terminologies (Range, Span, Settling time dead zone, input impedance ...) 1st order and 2nd order instruments with step, ramp and sinusoidal input/output characteristics, Transducer and types

UNIT - 2

Measurement of force torque, velocity

Electric balance, different types of load cells, magnets, elastics load cell-strain gauge load cell- different methods of torque measurement, strain gauge, relative regular twist-speed measurement-revaluation counter- capacitive tacho-drag up type tacho D.C and A.C tacho generators - stroboscope

UNIT - 3

Measurement of acceleration, vibration and density

Accelerometers - LVDT, piezo-electric, strain gauge and variable reluctance type accelerometers mechanical type vibration instruments - seismic instrument as an accelerometer and vibrometer calibration of vibration pickups - units of density, specific gravity and viscosity used in industries -Baume scale API scale - pressure head type densitometer - float type densitometer - ultrasonic densitometer Bridge type gas densitometer

UNIT - 4

Pressure measurement

Units of pressure - manometers - different types - elastic type pressure gauges - Bourde type bellows - diaphragms - Electrical methods - elastic elements with LVDT and strain gauges - capacitive type pressure gauge - piezo resistive pressure sensor - resonator pressure sensor - measurement of vacuum - McLeod gauge - thermal conductivity gauges - Ionization gauge cold cathode and hot cathode types - testing and calibration of pressure gauges - dead weight tester

UNIT - 5

Temperature measurement

Definitions and standards - primary and secondary fixed points - calibration of thermometers different types of filled in system thermometer - sources of errors in filled in systems and their compensation - Bimetallic thermometers - Electrical methods of temperature measurement - signal conditioning of industrial RTDs and their characteristics -3 lead and 4 lead RTDs

UNIT - 6

Thermocouples and pyrometers

Thermocouples, law of thermocouple, fabrication of industrial thermocouples, signal conditioning of thermocouple output, thermal block references functions, commercial circuits for cold junction compensation, response of thermocouple, special techniques for measuring high temperature using thermocouples, Radiation methods of temperature measurement, radiation fundamentals, total radiation and selective radiation pyrometers, optical pyrometer, two colour radiation pyrometer

TEXT/REFERENCE BOOKS

- Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, IV Edition, McGraw Hill Book Company, 1998
- 2. R. K. Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999
- **3.** D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999
- **4.** A. K. Sawhney, A course in Electrical and Electronic Measurement and Instrumentation Dhanpat Raj and Sons, New Delhi, 1999
- P. Holman, Experimental Methods for Engineers International Student Edition, McGraw Hill Book Company, 1971
- **6.** B. C. Nakra and K. K .Chaudary, Instrumentation Measurement and Analysis, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1985

BET501	Analog Circuits	8 Credits

UNIT - 1

Operational Amplifier

Operational Amplifiers, Difference Amplifiers, Biasing of Differential Amplifiers, Practical Operational Amplifier, Parameters of an OPAMP, Open loop OPAMP Configuration, Closed Loop Amplifier, Voltage Shunt Feedback

UNIT - 2

OPAMP Applications

Applications of Operational Amplifiers, Filters and Precision Diode, Schmitt Trigger and Relaxation Oscillator

UNIT - 3

Oscillator

Oscillators, Harmonic Oscillators, Tuned Oscillators

UNIT - 4

Voltage Regulators

Voltage Regulators, Design of Series Voltage Regulator, Series regulator with Current Pre- regulator

Specialized IC Applications

Audio power amplifiers, IC 555, IC LM 380, video amplifier IC LM 733, study of analog multiplier

UNIT - 6

Phase Lock Loop (PLL)

Study of VCO using IC 566, Operating principles of PLL & its transfer characteristics, Lock range, Capture range, Applications of PLL, Study of PLL IC 565

TEXT/REFERENCE BOOKS

- 1. Ramakant Gaikwad, "Op-Amp and Linear IC Technology", PHI, New Delhi-5th Edition-2008
- 2. K.C. Botkar, "Integrated Circuit", Khanna Publishers- 3rd Edition-1997
- 3. Franco, "Design with Op-Amp and Analog IC's", TMH Bosten-3rd Edition-2002

4. Coughlin, "Operational Amplifiers and Linear Integrated Circuits", Pearson Education, New Delhi, 2001, 6th edition

BET502	Micro-Controllers and Applications	8 Credits

UNIT - 1

Introduction to microprocessor

Introduction to the general structure of 8 and 16 bit Microprocessor & microcontroller

UNIT - 2 Microcontrollers and Embedded Processors Discussions on instruction sets, memory hierarchies of 8 and 16 bit microcontrollers such as, Intel 8048, 8051, 8096, Motorola, MC68HC11, PIC Microcontrollers UNIT - 3

8051 Assembly Language Programming

Development of system software in assembly language, debugging and troubleshooting

Interfacing

Interfacing of external Memory, I/O devices and serial communication with typical microcontrollers

UNIT - 5

System design with microcontrollers

Typical examples such as Remote Terminal Unit (RTU), Prepayment Energy Meters, or any other suitable examples

UNIT - 6

Advanced Microcontroller and design

Features of MCS-96 Family Microcontrollers, Architecture, pin Configuration of 80c196, Highlighting development of schematic, circuit layout and PCB design.

TEXT/REFERENCE BOOKS

1. M. A. Mazidi and J. G. Mazidi, "8051 Microcontroller & Embedded System" Pearson

Education Asia, 2000

UNIT - 4

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- 2. K. J. Ayala, "The 8051 Microcontroller", Penram International Pub, 1996
- Sencer Yeralan, Ashuutosh Ahuwalia, "Programming and Interfacing the 8051 Microcontroller", Addison Wesely Longman Inc
- **4.** Frank Vahid and Tony Givargis, "Embedded System Design : A Unified Hardware/Software Introduction", John Wiley & Sons
- 5. Peatman, "PIC Microcontroller", Pearson Education Asia
- 6. Ajay Deshmukh, "PIC microconrollers", Pearson Education
- **7.** Raj Kamal, "Microcontrollers, architecture, programming, Interfacing and System Design", Pearson Education

BET503

Digital Signal Processing

8 Credits

UNIT - 1

Signals and signal processing

Characterization and classification of signals, typical signal processing operations, typical signal processing applications, Advantages of digital signal processing

UNIT - 2

Time domain representations of signals and systems

Discrete time signals, Operations on sequences, discrete time systems, Linear time invariant discrete time systems, Characterization of LTI systems

UNIT - 3

Transform domain representation of signals and systems

The discrete time Fourier transform, The frequency response, The transfer function, Discrete Fourier series, Discrete Fourier transform, Computation of DFT, Linear convolution using DFT, The z-transform, The region of convergence of z-transform

UNIT - 4

Structures for discrete time systems

Block diagram and signal flow representation of constant coefficient linear difference equation, Basic structures for IIR systems, Basic structures for FIR systems, Lattice structures, Effects of coefficient quantization, Effect of round off noise in digital filters, Zero-input limit cycles

UNIT - 5

Filter design techniques

BET504

Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing, Optimum approximation of FIR filters, linear phase filters

UNIT - 6

Sampling of continuous time signals

Periodic sampling, Frequency domain representation of sampling, Reconstruction of band limited signal from its samples, Discrete time processing of continuous time signals, Continuous time processing of discrete time signals, Changing the sampling rate using discrete time processing

TEXT/REFERENCE BOOKS

- 1. Oppenheim & Schafer, "Discrete Time Signal Processing", PHI, 2003, 4th edition
- 2. Proakis, "Digital Signal Processing", PHI, 2005, 3rd edition
- 3. Sanjit Mitra, "Digital Signal Processing A Computer Based Approach", MCG, 2005 Johnson,

"Introduction to DSP", PHI, 2001, 2nd edition

Electromagnetic Fields 8 Credits

UNIT - 1

Mathematical Fundamentals and Static Electric Fields

Introduction, Vector Analysis, Coordinate systems and Transformations, Line, surface and volume integrals, Divergence Theorem, Stoke's theorem, Columb's Law, Electric Field, Electric flux density, Gauss's Law with Application, Electrostatic Potential and Equipotential Surfaces, Boundary conditions for Electrostatic fields, Capacitance and Capacitors, Electrostatic Energy and Energy Density, Poisson's and Laplace's Equations, Uniqueness Theorem, Method of Images, Electrostatic boundary value problem

UNIT - 2

Steady Electric Currents and Static Magnetic Fields

Current Density and Ohm's Law, Electromotive force and Kirchhoff's Voltage Law, Continuity Equation and Kirchhoff's Current Law, Power Dissipation and Joule's Law, Biot- Savart Law and its Application, Ampere's Circuital Law and its Application, Magnetic Flux Density, Magnetic Scalar and Vector Potentials, Boundary Condition Magnetic Fields, Inductance and Inductor, Energy stored in Magnetic Field

UNIT - 3

Time Varying Field & Maxwell's Equations

Introduction, Faraday's Law of electromagnetic Induction, Maxwell's Equation, Boundary Conditions for Electromagnetic fields, Time Harmonic Fields

UNIT - 4

Electromagnetic Waves

The Helmhotz Equation, Plane waves in Lossless medium, Plane waves in a lossy medium, Poynting Vector and Power Flow in Electromagnetic Fields, Polarization of plane wave, Behavior of Plane waves at the interface of two media

UNIT - 5

Fundamental of Antennas and Radiating Systems

Introduction, Fundamentals of Radiation, Radiated field of an Herzian dipole, Basic Antenna Parameters, Half Wave Dipole Antenna, Quarter Wave Monopole Antenna, Small Loop Antennas, Introduction to Antenna Arrays

UNIT - 6

Introduction to Numerical Techniques in Electromagnetics

Introduction, Finite difference method, Basic Concepts of the Method of Moments, Method of Moment for Wire Antennas and Wire Scatterers

TEXT/REFERENCE BOOKS

- 1. Sadiku, "Elements of Electromagnetics", Oxford
- 2. Krauss, "Electromagnetics", McGraw Hill, New York, 4th edition
- 3. W. H. Hayt, "Engineering Electromagnetics", McGraw Hill , New Delhi , 1999
- 4. Edminister, Schaum series, "Electromagnetics", McGraw Hill, New York, 1993, 2nd edition
- 5. Sarvate, "Electromagnetism", Wiley Eastern

BET505A	Elective-II: Probability and Random Processes	6 Credits

UNIT - 1

Introduction to Probability

Definitions, scope and history; limitation of classical and relative-frequency-based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications

Random variables

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties, Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables, Function of random a variable, pdf of the function of a random variable; Function of two random variables; Sum of two independent random variables, mean, variance and moments of a random variable, Joint moments, conditional expectation; covariance and correlation, independent, uncorrelated and orthogonal random variables

UNIT - 3

Random vector and distributions

Mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector-space representation of random variables, linear independence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean-square error and orthogonality principle in estimation; Moment-generating and characteristic functions and their applications, Bounds and approximations: Chebysev inequality and Chernoff Bound

UNIT - 4

Sequence of random variables and convergence

Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance

UNIT - 5

Random process

Random process: realizations, sample paths, discrete and continuous time processes, examples, Probabilistic structure of a random process; mean, autocorrelation and auto-covariance functions, Stationarity: strict-sense stationary (SSS) and wide-sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross-correlation function, Ergodicity and its importance

UNIT - 6

Spectral representation of a real WSS process

power spectral density, properties of power spectral density, cross-power spectral density and properties; auto- correlation function and power spectral density of a WSS random sequence, Linear time-invariant system with a WSS process as an input: sationarity of the output, auto-correlation and power-spectral density of the output; examples with white-noise as input; linear shift-invariant discrete-time system with a WSS sequence as input, Spectral factorization theorem, Examples of random processes: white noise process and white noise sequence; Gaussian process; Poisson process, Markov Process

TEXT/REFERENCE BOOKS

- 1. Probability and Random Processes by Geoffrey Grimmett, David Stirzaker
- 2. Probability, random processes, and estimation theory for engineers by Henry Stark, John

William Woods

BET505B	Elective-II: Nano electronics: Devices and Materials	6 Credits
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UNIT - 1

Overview Nano Technology

Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow

UNIT - 2

MOS Scaling theory

MOS Scaling theory, Issues in scaling MOS, transistors: Short channel, effects, Description of a typical 65 nm MOS technology. Requirements for Non classical MOS transistor, MOS capacitor, Role of interface quality and related process techniques, Gate oxide thickness scaling trend, SiO2 vs. High-k gate dielectrics, Integration, Issues of high-k .Interface states, bulk charge, band offset, stability, reliability - Qbd high field, possible candidates, CV and IV techniques

UNIT - 3

SOI (Silicon on insulator)

Metal gate transistor: Motivation, requirements Integration Issues, Transport in Nano MOSFET, velocity saturation, ballistic transport, injection velocity, velocity overshoot, SOI - PDSOI and FDSOI, Ultrathin body SOI - double gate transistors, integration issues

UNIT - 4

Properties of Nano devices

Vertical transistors -Fin FET and Surround gate FET. Metal source/drain junctions – Properties of schotky functions on Silicon, Germanium and compound semiconductors -Work function pinning

UNIT - 5

Nano electronics Semiconductor devices

Germanium Nano MOSFETs: strain, quantization, Advantages of Germanium over Silicon, PMOS versus NMOS, Compound semiconductors - material properties, MESFETs Compound Semiconductors

MOSFETs in the context of channel quantization and strain, Hetero structure MOSFETs exploiting novel materials, strain, quantization

UNIT - 6

Characterization techniques for Nano materials

FTIR, XRD, AFM, SEM, TEM, EDAX Applications and interpretation of results, Emerging nanomaterial, nanotubes, Nano rods and other Nano structures, LB technique, Soft lithography Microwave assisted synthesis, Self assembly

TEXT/REFERENCE BOOKS

- 1. Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press
- 2. Silicon VLSI Technology, Plummer, Deal, Griffin, Pearson Education India
- 3. Encyclopedia of Materials Characterization, Edited by: Brundle, C. Richard; Evans, Charles A.

Jr.; Wilson, Shaun; Elsevier

BET505C

Elective-II: Digital Voice and Picture Communication

6 Credits

UNIT - 1

Introduction Speech Processing

Speech Production Model, Speech Coding: Objectives and Requirements, Quantizers for Speech Signal, mew - Law and Optimum Quantizer, Adaptive Quantizer, Differential, Quantization, LDM and ADM .Differential PCM and Adaptive Prediction. Linear Prediction of Speech. Computational Aspects of LPC parameters, Cholesky Decomposition, Lattice Formulation of LPC Coefficient, Linear Predictive Synthesizer, LPC Vocoder

UNIT - 2

Image and Video Coding

Introduction to Image and Video Coding, Lossy Image Compression, Quantization and Limitations, Theory of Wavelets. Discrete Wavelet Transforms. DWT on the Images and its Encoding. - Embedded Zero Tree Wavelet Encoding

UNIT - 3

Video Coding

Basic Building Blocks, Motion Estimate Techniques, Fast Motion Estimation Techniques, Video Coding Standards, Advanced Coding Aspects

Audio Coding

Basic Concepts, Audio Coding AC, AC -3 Decoder, MPEG - 1 Audio Coding

UNIT - 5

VoIP

Introduction to VoIP, VoIP Signaling: H.323 Protocol, H.323 Call Controls and Enhancements Interworking with PSTN Limitations and Solution

UNIT - 6

Multiplexing Schemes

H. 323: Multiplexing: Header Compression and BW, ISDN Video Conferencing, Video Conferencing: SIP Protocol, 4G Multimedia Conferencing

TEXT/REFERENCE BOOKS

- 1. Introduction to Digital Audio Coding and Standards by Marina Bosi, Richard E. Goldberg, Springer, 2002
- 2. Principles of Digital Audio by Pohlmann, Ken C. McGraw-Hill/TAB Electronics, 2005
- 3. Voice Over IP Networks Marcus Goncalves McGraw-Hill Professional
- **4.** VoIP Standards and Protocols Faulkner Information Services
- 5. Voice Over IP Technologies: Building the Converged Network Mark A. Miller John Wiley & Sons
- 6. An Introduction to Speech Recognition by B. Plannerer
- 7. Speech Processing: A Dynamic and Optimization-Oriented Approach by Li Deng

BET601	Control Engineering	8 Credits
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UNIT - 1

Introduction to control problem

Industrial Control examples, Transfer function models of mechanical, electrical, thermal and hydraulic systems, ystem with dead-time, System response, Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tachogenerators, electro hydraulic valves, hydraulic servomotors, electropeumatic valves, pneumatic actuators, Closed-loop systems, Block diagram and signal flow graph analysis, transfer function

UNIT - 2

Basic characteristics of feedback control systems

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness, Basic modes of feedback control: proportional, integral and derivative. Feed-forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion

UNIT - 3

Time Response Analysis of Control Systems

Time response of second-order systems, steady-state errors and error constants, Performance specifications in time-domain, Root locus method of design, Lead and lag compensation

UNIT - 4

Frequency-response analysis

Relationship between time & frequency response, Polar plots, Bode's plot, stability in frequency domain, Nyquist plots, Nyquist stability criterion, Performance specifications in frequency- domain, Frequency-domain methods of design, Compensation & their realization in time & frequency domain, Lead and Lag compensation, Op-amp based and digital implementation of compensators. Tuning of process controllers, State variable formulation and solution

UNIT - 5

State variable Analysis

Concepts of state, state variable, state model, state models for linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability

UNIT - 6

Introduction to Optimal control & nonlinear control

Optimal Control problem, Regulator problem, Output Nonlinear system - Basic concept & analysis

TEXT/REFERENCE BOOKS

- 1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw -Hill, 1997
- 2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993
- **3.** Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991
- 4. Nagrath & Gopal, "Modern Control Engineering", New Ages International

BET602

Advanced Antenna Theory

8 Credits

UNIT - 1

Fundamental Concepts

Physical concept of radiation, Radiation pattern, near-and far-field regions, reciprocity, directivity and gain, effective aperture, polarization, input impedance, efficiency, Friis transmission equation, radiation integrals and auxiliary potential functions

UNIT - 2

Radiation from Wires and Loops

Infinitesimal dipole, finite-length dipole, linear elements near conductors, dipoles for mobile communication, small circular loop

UNIT - 3

Aperture and Reflector Antennas

Huygens' Principle, radiation from rectangular and circular apertures, design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, design concepts, prime-focus parabolic reflector and cassegrain antennas.

UNIT - 4

Broadband Antennas

Log-periodic and Yagi antennas, frequency independent antennas, broadcast antennas

UNIT - 5

Microstrip Antennas

Basic characteristics of microstrip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas

UNIT - 6

Antenna Arrays and Basic Concepts of Smart Antennas

Analysis of uniformly spaced arrays with uniform and non- uniform excitation amplitudes, extension to planar arrays, synthesis of antenna arrays using Schelkunoff polynomial method, Woodward-Lawson method, Concept and benefits of smart antennas, Fixed weight beamforming basics, Adaptive beamforming

TEXT/REFERENCE BOOKS

- 1. Roddy Cooln, "Electronics Communication", PHI, 2000, 3rd edition
- 2. Kennedy, "Electronics Communication System", McGraw Hill, 1995, 2nd edition
- 3. K. D. Prasad, "Antenna and Wave Propagation", 1995, 2nd edition
- 4. John D. Kraus, "Antenna", Tata McGraw Hill, 1998, 2nd edition
- 5. Balanis, "Antenna theory, Antenna Engineering Handbook", McGraw Hill

Page 53

6. Johnson, "Antenna Engineering Handbook"

BET603	Digital Communication	8 Credits

UNIT - 1

Introduction to Digital Communications and Information Theory

Introduction to Digital Communications, Signals and Sampling Theory, Information Theoretic Approach to Digital Communications, Coding for Discrete Sources

UNIT - 2

Random Processes

Introduction to Random variables, Functions of Random Variable, Some useful Distributions Stochastic Processes, Introduction to Statistical Signal Processing

UNIT - 3

Quantization and Coding

Quantization and Preprocessing, Pulse Code Modulation (PCM), Logarithmic Pulse Code Modulation (Log PCM) and Companding, Differential Pulse Code Modulation (DPCM), Delta Modulation

UNIT - 4

Signal Representation and Baseband Processing

Orthogonality, Representation of Signals, Noise Response of Linear System to Random Processes, Maximum Likelihood Detection and Correlation Receiver Structure, Matched Filter, Nyquist Filtering and Inter Symbol Interference

UNIT - 5

Carrier Modulation

Introduction to Carrier Modulation, Amplitude Shift Keying (ASK) and Frequency Shift Keying (FSK) Modulations, Binary Phase Shift Keying (BPSK) Modulation, Quaternary Phase Shift Keying QPSK) and M-ary PSK Modulations, Differential Encoding and Decoding, Performance of BPSK and QPSK in AWGN channel, Performance of binary FSK and M-ary PSK in AWGN channel, Minimum Shift Keying (MSK) Modulation, Orthogonal Frequency Division Multiplexing (OFDM), Carrier Synchronization, Timing Synchronization

UNIT - 6

Channel Coding, Spread Spectrum and Multiple Access Techniques

Introduction to Error Control Coding, Block Codes, Convolutional codes, Coded Modulation Schemes, Turbo Codes, Introduction to Spread Spectrum Modulation, Code Acquisition and Tracking, Spread Spectrum as a Multiple Access Techniques

TEXT/REFERENCE BOOKS

- 1. Taub & Schilling, "Analog And Digital Communication", McGraw-Hill, New Delhi, 1991, 2nd edition
- 2. B.P. Lathi, "Analog and Digital Communication", TMH, New Delhi, 1997, 2nd edition
- 3. S.D. Sapre, R. P. Singh, "Communication Systems- Analog and Digital", TMH, New Delhi, 1995, 2nd edition
- 4. Hsu, Shaum Series, "Analog and Digital Communication", McGraw Hill

BET604

Digital System Design

8 Credits

UNIT - 1

Introduction to Digital Design and Digital Logic

What is Digital?, Specification and Implementation of digital design, Structured and Trial-Error methods in design, Digital Computer Aided Design (CAD) tools, Binary Number System, Octal, Hexadecimal and BCD Codes, Number System Conversion, Use of different number systems in digital design, Logic gates - AND, OR, NOT, NAND, NOR etc., NAND and NOR implementation of real life digital circuits

UNIT - 2

Boolean algebra

AND, OR and other relations, DeMorgan's law, Karnaugh Maps, Minimization of Sum of Products and Product of Sums, Design of minimal two-level gate networks, Design of multiple output two level gate networks

UNIT - 3

Combinational Circuit Design

Design Procedure: Design of Multiplexer, Decoder, Encoder, Comparator, Design of Seven- segment display, Parity generator, Design of large circuits using the above modules

UNIT - 4

Synchronous Sequential Circuit Design

Design of sequential modules - SR, D, T and J-K Flip-flops, Flip-flop applications - Clock generation, Counters, Registers, Basic State machine concepts

UNIT - 5

Design of Programmable Logic

Introduction to Programmable circuits, Design of Read-Only Memory (ROM), Programmable Logic Arrays (PLA), Programmable Array Logic (PAL)

UNIT - 6

Digital Computing

Introduction to digital computer, Design of Arithmetic circuits - Adders, Multipliers, Design of Memory - ROM/RAM, Design of a simple CPU

TEXT/REFERENCE BOOKS

- 1. Wakerly, "Digital Design", Pearson Education, 2002
- 2. Richard Sandige, "Modern Digital Design", McGH, 1990, international edition
- 3. Douglas Perry, "VHDL Programming by examples- 3rd edition", TMH
- 4. Z Navabi, "Analysis and Modeling of Digital Systems", TMH 2nd edition
- 5. Joseph Pick, "VHDL Techniques, Experiments and Caveats", TMH

BET605A	Elective-III: MEMS and Microsystems	8 Credits
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UNIT - 1

Introduction to MEMS & Microsystems

Introduction to Micro sensors, Evaluation of MEMS, Micro sensors, Market Survey

UNIT - 2

Technology and Fabrication

MEMS Materials, MEMS Materials Properties, Microelectronic Technology for MEMS - II, Microelectronic Technology for MEMS - III, Micromachining Technology for MEMS, Micromachining Process, Etch Stop Techniques and Microstructure, Surface and Quartz Micromachining, Fabrication of Micro machined Microstructure, Micro stereo lithography

UNIT - 3

MEMS Sensors

MEMS Micro sensors Thermal, Micro machined Micro sensors Mechanical, MEMS Pressure and Flow Sensor, Micro machined Flow Sensors, MEMS Inertial Sensors and MEMS Gyro Sensor

MEMS Accelerometer

Micro machined Micro accelerometers for MEMS, MEMS Accelerometers for Avionics, Piezoresistive Accelerometer Technology, MEMS Capacitive Accelerometer and MEMS Capacitive Accelerometer Process

UNIT - 5

Interface Electronics for MEMS

Temperature Drift and Damping Analysis, Polymer MEMS & Carbon Nano Tubes CNT, Wafer Bonding & Packaging of MEMS

UNIT - 6

Application of MEMS

MEMS for Space Application, MEMS for Biomedical Applications (Bio-MEMS)

TEXT/REFERENCE BOOKS

- 1. Volker Kempe, "Inertial MEMS: Principles and Practice"
- 2. Vijay K. Varadan, K. J. Vinoy, K. A. Jose and Udo Zoelzer, "RF Mems & Their Applications"
- 3. Enabling Technologies for MEMS and Nano devices
- 4. Photonic MEMS Devices: Design, Fabrication and Control (Optical Science and Engineering)
- 5. Mems & Microsystems Design & Manufacture by Hsu
- 6. Micro Mechanical Systems: Principles and Technology by Toshio Fukuda, Wolfgang Menz

BET605B	Power Electronics	8 Credits

UNIT - 1

Thyristors and Its Applications

Invention of SCR and its impact, Advent of Self commutated switches and their impact, SCR: Device structure, Static characteristic, dynamic characteristic constraints of Turn on and Turn off time, different relevant ratings, Different types of switches, Power diodes, Power Supplies - Revolution in Personal Computers UPS

UNIT - 2

AC to DC controlled converters

Single phase half controlled converter: Principle of operation, Single phase Half wave with R load, Single phase Half wave with R-L load, Single phase fully controlled converter: Principle of operation, Continuous mode of conduction: expression for average output voltage, Discontinuous mode of

conduction: expression for average output voltage, Single phase full wave with R load, Single phase full wave with R-L load, Three phase ac to dc converter: Three phase half wave ac to dc converter: Principle of operation, Derivation of o/p voltage, Three phase fully controlled ac to dc converter: Principle of operation, Derivation of average output voltage, Effect of source impedance, Dual converter, Introduction to single-phase and three-phase AC voltage regulators, Single-phase and three-phase cyclo-converters

UNIT - 3

Protection Techniques

Over voltage and over current protection, Gate protection, Heating, cooling and mounting of thyristors, SCR reliability.

UNIT - 4

Choppers (DC - DC Power Converters)

Introduction to step-up and step-down chopper, Types of choppers: Single quadrant, two quadrants, and four quadrants, Jone's chopper and Morgan's chopper, Multiphase choppers, Introduction to AC choppers

UNIT - 5

Inverters (DC- AC Power Converters)

Principle of operation of Inverters, Series and parallel inverters, Voltage source inverters, Current source inverters, Bridge inverters

UNIT - 6

AC and DC Drive Controls using Thyristors

Speed control of DC and AC motors using SCRs, Temperature control, Stepper motor control

TEXT/REFERENCE BOOKS

- 1. Singh, Khanchandani, "Power Electronics", TMH, New Delhi, 2000, 5th edition
- 2. M. H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, New Delhi,

2004, 3rd edition

- 3. P. C. Sen, "Power Electronics", TMH, New Delhi, 1992, 2nd edition
- 4. V. R. Moorthi, "Power Electronics: Devices, Circuits and Industrial Applications", Oxford University

Press, New Delhi, 2005, 1st edition

BET605C Elective-III: Advanced 3G and 4G Wireless Mobile Communications 8 Credits

UNIT - 1

Wireless Communications and Diversity

Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity, Types of Diversity - Frequency, Time, Space

UNIT - 2

Broadband Wireless Channel Modeling and Cellular Communications

WSSUS Channel Modeling, RMS Delay Spread, Doppler Fading, Jakes Model, Autocorrelation, Jakes Spectrum, Impact of Doppler Fading, Introduction to Cellular Communications, Frequency reuse, Multiple Access Technologies, Cellular Processes - Call Setup, Handover etc., Teletraffic Theory

UNIT - 3

CDMA and OFDM

Introduction to CDMA, Walsh codes, Variable tree OVSF, PN Sequences, Multipath diversity, RAKE Receiver, CDMA Receiver Synchronization, Introduction to OFDM, Multicarrier Modulation and Cyclic Prefix, Channel model and SNR performance, OFDM Issues - PAPR, Frequency and Timing Offset Issues

UNIT - 4

MIMO

Introduction to MIMO, MIMO Channel Capacity, SVD and Eigen modes of the MIMO Channel, MIMO Spatial Multiplexing - BLAST, MIMO Diversity - Alamouti, OSTBC, MRT, MIMO - OFDM

UNIT - 5

UWB (Ultra wide Band)

UWB Definition and Features, UWB Wireless Channels, UWB Data Modulation, Uniform Pulse Train, Bit - Error Rate Performance of UWB

UNIT - 6

3G and 4G Wireless Standards GSM, GPRS, WCDMA, LTE, WiMAX

TEXT/REFERENCE BOOKS

- **1.** Fundamentals of Wireless Communications David Tse and Pramod Viswanath, Publisher Cambridge University Press
- 2. Wireless Communications: Andrea Goldsmith, Cambridge University Press

3.Wireless Communications: Principles and Practice -Theodore Rappaport- Prentice Hall. MIMO Wireless Communications - Ezio Biglieri - Cambridge University Press

Digital Image Processing

UNIT - 1

Introduction, Digital Image definitions, Common Values, Characteristics of Image Operations, Types of Operations, Types of neighborhoods, Video parameters, Tools, 2D convolution, Properties of 2D convolution, 2D Fourier Transforms, Properties of 2D Fourier Transforms, Importance of phase and magnitude, Circularly Symmetric Signals, Examples of 2D Signals and transforms, Statistical **Description of Images**

Image Perception

BET701

Statistical Description of Images, Perception, Brightness Sensitivity, Wavelength Sensitivity, Stimulus Sensitivity, Spatial Frequency Sensitivity, Psychophysics of Color vision, Perceived color, Color metrics, CIE chromaticity coordinates, Spatial effects in color vision, Optical illusions

UNIT - 3

Image Sampling

Two dimensional Sampling theory, Extensions of sampling theory, Non rectangular Grid sampling, Hexagonal sampling, Optimal sampling, Image Quantization: The optimum Mean Square Lloyd-Max quantiser, Optimum mean square uniform quantiser for non-uniform densities, Analytic Models for practical quantiers, Visual quantization, Vector Quantization

UNIT - 4

Image Transforms

Two dimensional orthogonal and unitary transforms, Separable unitary transforms, Basis images, Dimensionality of Image Transforms, Discrete linear orthogonal, DFT, WHT, KLT, DCT and SVD, Quantisation of Transform coefficients, Transform Coding of Color images

UNIT - 5

Image Enhancement

Contrast and dynamic Range Modification, Histogram-based operations, Smoothing operations, Edge Detection-derivative based operation, Image Interpolation and Motion Estimation, Pseudo coloring

UNIT - 6

Image Restoration

Image Restoration, Degradation Estimation, Reduction of Additive Noise, Reduction of Image Blurring, Simultaneous reduction of noise and blurring, Reduction of Signal dependent noise, Temporal filtering

8 Credits

for Image Restoration, Extrapolation of Band limited Signals

Text Books

- 1. Rafael C. Gonzalez and Woods, "Digital Image Processing", Addison Wesley, 1998
- 2. A. K. Jain, "Digital Image Processing", PHI, New Delhi, 1997
- 3. Pratt W.K., "Digital Image Processing", 2nd Edition, John Wiley, New York, 2001
- 4. Edward R. Dougherty, "Random Processes for Image and Signal Processing", PHI-2001

BET702	Optical Communication	8 Credits
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UNIT - 1

Optical communication fundamentals

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model. Different types of optical fibers, Modal analysis of a step index fiber. Signal degradation on optical fiber due to dispersion and attenuation

UNIT - 2

Optical sources

LEDs: structure and its characteristics, Lasers: structure and its characteristics

UNIT - 3

Optical detectors

Photo-detectors - pin- detectors, detector responsivity, noise, optical receivers

Fabrication Techniques

Fabrication of fibers and measurement techniques like OTDR

UNIT - 5

Optical link design

BER calculation, quantum limit, power penalties, Optical switches - coupled mode analysis of directional couplers, electro-optic switches, nonlinear effects in fiber optic links

UNIT - 6

Optical Modulation

Concept of self-phase modulation, group velocity dispersion and solution based communication. Optical amplifiers - EDFA, Raman amplifier, and WDM systems

TEXT/REFERENCE BOOKS

- **1.** J. Keiser, Fiber Optic communication, McGraw-Hill, 2nd Ed. 1992
- 2. J. E. Midwinter, Optical fibers for transmission, John Wiley, 1979
- **3.** T. Tamir, Integrated optics (Topics in Applied Physics Vol.7), Springer-Verlag, 1975
- 4. J. Gowar, Optical communication systems, Prentice Hall India, 1987
- 5. S. E. Miller and A.G. Chynoweth, eds., Optical fibers telecommunications, Academic Press, 1979
- 6. G. Agrawal, Nonlinear fiber optics, Academic Press, 2nd Ed, 1994
- 7. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1992
- 8. Jhon Senior, "Optical Fiber Communications-Principles & Practices", 2nd Edition, PHI-2001

BET703A	VLSI Design

6 Credits

UNIT - 1

Review of digital design

MUX based digital design, Design using ROM, Programmable Logic Arrays (PLA) and Programmable Array Logic (PAL), Sequential circuits and timing - Setup and hold times, Sequential circuit design design of Moore and Mealy circuits, Design of a pattern sequence detector using MUX, ROM and PAL, and Design of a vending machine controller using PAL

UNIT - 2

Introduction to Verilog coding

Introduction to Verilog, Realization of Combinational and sequential circuits, RTL coding guidelines, Coding organization and writing a test bench

UNIT - 3

Simulation, Synthesis, Place and Route, and Back Annotation

Design flow, Simulation using Modelsim, Synthesis using Synplify, Place and Route, and Back Annotation using Xilinx

UNIT - 4

Design Applications-I

Design using Algorithmic State Machine Charts

Derivation of ASM charts, Design examples such as dice game, etc. using ASM charts, Implementation of ASM charts using microprogramming, and Verilog design of bus arbitrator

Design of memories

Verilog realization of Read Only Memory (ROM), Verilog realization of Random Access Memory (RAM), and Verilog coding of controller for accessing external memory

UNIT - 5

Design Applications-II

Design of Arithmetic functions

Pipelining concept, Verilog design of a pipelined adder/subtractor, Design of Multipliers, and Verilog design of a pipelined multiplier

Design for testability

Testing combinational and sequential logic, Boundary scan testing, and Built-in self-test

Design Applications

Design of a traffic light controller using Verilog, and Design of discrete cosine transform and quantization processor for video compression using Verilog

UNIT - 6

Hardware implementation using FPGA board

Features of FPGA board and demonstration of traffic light controller design, and Universal, asynchronous, receiver-transmitter design using FPGA board

TEXT/REFERENCE BOOKS

- 1. Wakerly, "Digital Design", Pearson Education, 2002
- 2. Richard Sandige, "Modern Digital Design", McGH, 1990, International Edition
- 3. Douglas Perry, "VHDL Programming by examples- 3rd edition", TMH
- 4. J. Bhasker, "A Verilog HDL Primer", Third Edition, 2005
- **5.** Douglas J. Smith, "HDL Chip Design: A Practical guide for Designing Synthesizing and Simulating ASICs and FPGAs using VHDL or Verilog", 1996

BET703B

Electromagnetic Compatibility for Circuit Designers

6 Credits

UNIT - 1

Introduction to EMI/EMC

What is EMI/EMC?, Why electronic designer to learn this? Why are we concern about regulations and standards?

UNIT - 2

EMI in Analog Circuits

The basic noise entry modes for the analog circuits, How to compute noise in each case with examples, Shielded cable to reduce the H filed pick up, Shielded cable noise reduction mechanism, Shield cut-off frequency calculation, Addition of common mode choke to reduce the shield cut-off frequency of the shielded cable, Design of common mode choke, Radiation emission reduction characteristics of the shielded cable, Ground loop problems with examples, Use of instrumentation amplifier for ground noise reduction, Use of shielded cable for the instrumentation amplifier, Circulating current reduction techniques, Use of Isolation amplifier, Noise reduction characteristics. Example with bio-medical amplifier, Use of current transmitters for the noise reduction, Examples with 4-20 ma current transmitters, Power supply induced noise and the design of RC filter for the circuits with examples, Shielding of transformers and the characteristics of power supplies

UNIT - 3

EMI issues in power circuits

Conducted noise emission from SMPS, Reduction methods, Conducted noise emission calculation in frequency domain using graphical methods, Conducted noise emission standards, Use of line filters, Design of line filters, and Measurements in line filters

UNIT - 4

Case study in power circuits

Noise issues in PWM techniques, Ground loop problems in power converters, dv/dt problems in power converters, False triggering in power converters due to external pick up, Examples, Problems in short circuit protection, False trigging in thyristors, Voltage doubling effect in motor drive circuits, Common mode current in motor drive circuits, Issues in current mode control, Radiated emission issues in power converters, Reduction techniques, Power distribution issues in PCB using different converters, Filtering techniques

UNIT - 5

EMI issues in digital circuits

Power distribution in digital circuits, Power rail equivalent circuit, Frequency response of power rail, Reflection and cross talk issues in PCB for high speed circuits, Cross talk calculations, Issues due to reflections, Calculation of induced noise, Calculation of PCB track impedance, Ground bounce issues in

digital circuits, Use of Multilayer board and method of using them, Design of metallic cabinet for the electronic equipment, Calculation thickness and required type of metal from the EMI point of view, Noise in digital circuits due to mechanical switching, Reduction methods

UNIT - 6

Electrostatic Discharge

ESD wave forms, Design of equipment for ESD test, EMI standards and regulations

TEXT/REFERENCE BOOKS

1. Ott. H. W. "Noise reduction techniques in Electronic system", 2nd edition, John Wiley Interscience, New York, 1988

2. Clayton R. Paul, "Introduction to electromagnetic compatibility", John Wiley and Sons, Inc. 1991

BET704	Microwave Theory and Techniques	8 Credits
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UNIT - 1

Introduction to Microwaves

History of Microwaves, Microwave Frequency bands, Applications of Microwaves: Civil and Military, Medical, EMI/ EMC.

Mathematical model of Microwave Transmission: Concept of Mode, Characteristics of TEM, TE and TM Modes, Losses associated with microwave transmission. Concept of Impedance in Microwave transmission

UNIT - 2

Analysis of RF and Microwave Transmission Lines

Coaxial Line, Rectangular Waveguide, Circular waveguide, Stripline, Microstrip Line **Microwave Network Analysis:** Equivalent Voltages and currents for non-TEM lines, Network parameters for microwave Circuits

UNIT - 3

Scattering Parameters

Passive and Active microwave Devices: Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator. Microwave Active components: Diodes, Transistors, oscillators, mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave tubes: Klystron, TWT, Magnetron

Microwave Measurements: Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and

measurement of spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure, Measurement of Microwave antenna parameters

UNIT - 4

Microwave Design Principles

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

UNIT - 5

Microwave Antenna

Microwave Antenna Parameters, Microwave antenna for ground based systems, Microwave antenna for airborne based systems, Microwave antenna for satellite borne systems, Microwave Planar Antenna

UNIT - 6

Microwave Systems

Radar Systems, Cellular Phone, Satellite Communication, RFID, GPS.

Modern Trends in Microwaves Engineering:

Effect of Microwaves on human body, Medical and Civil applications of microwaves, Electromagnetic interference / Electromagnetic Compatibility (EMI/EMC), Monolithic Microwave IC fabrication, RFMEMS for microwave components, Microwave Imaging

TEXT/REFERENCE BOOKS

- 1. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India
- **2.** S. Ramo, J. R. Whinnery and T. V. Duzer, "Fields and Waves in Communication Electronics", Third Edition, Wiley India
- 3. R. E. Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press
- 4. Lieo, "Microwave Devices and Circuits"; PHI
- 5. Peter A. Rizzi, "Fundamentals of Microwave Engineering", Prentice Hall of India
- 6. Sisodia and Raghuvanshi, "Microwave Circuits and Passive Devices", Wiley Eastern
- 7. B. E. Keiser, "Principles of Electromagnetic Compatibility", Artech

BET705

Computer Organization & System Software

8 Credits

UNIT - 1

Processor Design

Processor organization, Information representation, Number formats, Instruction types, Fixed-point arithmetic: Addition, Subtraction, Multiplication and Division, ALU design: Basic ALU organization, Floating-point arithmetic, and Arithmetic processor

UNIT - 2

Control Unit Design

Instruction sequencing, Instruction interpretation, hardwired control unit design, Micro programmed control unit design

UNIT - 3

Memory Organization, Memory Technology and Classifications

Memory technology, Virtual memory concept, Segments, Pages and Files, Cache, Interleaved, Video, **Dual Port memory**

UNIT - 4

Input/output Organization and Data Transfer Methods

Programmed I/O, DMA control and Interrupt based I/O, Serial transmission, Synchronization, Bus arbitration techniques, Bus architectures: ISA, EISA, VESA, PCI and SCSI

UNIT - 5

Parallel Processing and Assembly Level Programming Concepts

Basic concepts, Performance considerations, Assembly level programming, Concepts of one pass and two pass assemblers, Macros

UNIT - 6

Loaders and Linkers and Operating Systems

Relocating and Linking Loaders, Fundamentals of operating systems: MS-DOS, Windows and Linux, Case study of IBM PC or compatible

TEXT/REFERENCE BOOKS

- 1. Donovan, "System Programming", TMH
- 2. Hayes, "Computer Architecture and Organization", McGraw-Hill

- 3. Moris Mano, "Computer system Architecture", PHI
- 4. William Gear, "Computer Organization and Programming", TMH
- 5. Dhamdhere, "Introduction to System Software", TMH

BET801	Satellite Communication Systems	8 Credits

UNIT - 1

Basic Principles

General features, frequency allocation for satellite services, properties of satellite communication systems, **Earth Station:** Introduction, earth station subsystem, different types of earth stations

Satellite Orbits

Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbital capacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping

UNIT - 2

UNIT - I

Satellite Construction (Space Segment)

Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification

UNIT - 4

Satellite Links

Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain

UNIT - 5

The Space Segment Access and Utilization

Introduction, space segment access methods: TDMA, FDMA, CDMA, SDMA, assignment methods

UNIT - 6

The Role and Application of Satellite Communication

Introduction to Digital Satellite and Mobile Satellite Communication

TEXT/REFERENCE BOOKS

. 11..

- 1. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons
- 2. Dennis Roddy, Satellite Communications, 3rd Ed., McGraw-Hill International Ed. 2001
- 3. W. L. Pritchard, J. A. Sciulli, Satellite Communication Systems Engineering, Prentice- Hall, Inc., NJ
- 4. M. O. Kolawole, Satellite Communication Engineering, Marcel Dekker, Inc. NY
- 5. Robert Gagliardi , "Satellite Communication" , CBS Publication
- 6. Ha, "Digital Satellite Communication", McGraw-Hill

7. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley and Sons

BET802	Computer Networks	8 Credits

UNIT - 1

Physical Layer

Data communications, type of networks, protocol & standards, the OSI model, TCP/IP suite, addressing schemes, data & signals, transmission impairments, transmission media, data rate limits, digital to digital conversion, transmission modes, switching techniques

UNIT - 2

Data Link Layer

Error detection & correction block coding, cyclic codes, checksum, data link layer design issues, protocols for noiseless & noisy channels, random access, controlled access

Connecting Devices: passive hubs, repeaters, active hubs, bridges, routers, two/three layer switches and gateways

UNIT - 3

Network Layer

Concept of datagram & VC, ICMP, IGMP, Delivery, Forwarding, Unicast & Multicast Routing Protocols

UNIT - 4

Transport Layer

Process to Process Delivery, UDP, TCP, Data Traffic, Congestion Control, QoS, Techniques to improve QoS, Integrated Services

UNIT - 5

Application Layer

Name Space, DNS, Distribution of Name Space, DNS in Internet, Resolution, TELNET, FTP, E-MAIL

UNIT - 6

Network Security

Introduction, systematic & asystematic key cryptography, security services, digital signature, entity authentication, key management

TEXT/REFERENCE BOOKS

1. B. A. Forouzan, "Data Communication & Networking" Tata McGraw Hill-4th Edition-2008

2. A. S. Tannenbaum, "Computer Networks", PHI- 4rd Edition-2006

3. B. A. Forouzan, "TCP-IP" Tata McGraw Hill-4th Edition-2008

4. W. Stallings, "Local Networks: An Introduction", Macmillan New York-2003

BET803A

Biomedical Electronics

6 Credits

UNIT - 1

Introduction to Electrophysiology and Cell Structure

Bioelectric signals: EEG, ECG, EMG, EOG, Muscle cell and nerve cell actions, resting potentials

UNIT - 2

Central Nervous and Cardio-Vascular System

Receptors, Motor systems, Neural and neuromuscular measurements, Evoked response of EEG, Structure of Heart, Rhythmicity, Pacemaker cells, ECG theory, Electrocardiograph, Measurement of blood pressure and blood flow, ECG electrodes, Life saving devices: Pacemaker, Defibrillators

UNIT - 3

Bio-signal Amplifiers and Signal Processing

Electrodes and transducers for biomedical applications, Basic requirements of op-Amp circuits and instrumentation amplifiers in biomedical applications, ECG data acquisition and biomedical signal processing

UNIT - 4

Intensive Care Instrumentation and Patient Safety

Bedside and central station monitoring systems, Introduction to bio-medical telemetry, Surgical Diathermy, Physiological effects of electricity, Macroshock and Microshock hazards, Basic approaches to protection against shock

Imaging and Display System

X-ray machine, CT-scanners, Ultrasound scanner, Nuclear methods, Recorders and displays: Inkjet, Thermal array, Fiber optic face plate CRT, Non fade CRO

UNIT - 6

Clinical Laboratory Equipment

Calorimeter, Spectro- photometers, Auto analyzers, Blood cell counter, Blood gas analyzers

TEXT/REFERENCE BOOKS

- 1. Leslie Cromwell, Fred Weibell and Erich A Pfeiffer, "Biomedical Instrumentation and Measurement", PHI
- 2. R. S. Khandpur, "Handbook of Biomedical Instrumentation", Tata McGraw Hill
- 3. Jacobson and Webster, "Medicine and Clinical Engineering", PHI
- 4. Carr and Brown, "Introduction to Biomedical Equipment Design", John Wiley

BET803B	Adaptive Signal Processing	6 Credits
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UNIT - 1

Stochastic Processes and Models

Introduction to Stochastic Processes, Partial characterization of a Discrete-time Stochastic Processes, Correlation Structure, Power Spectral Density and its Properties, Stochastic Models

UNIT - 2

Wiener Filters

Linear Optimum Filtering, Principle of Orthogonality, Minimum Mean-Square Error, Wiener-Hopf Equations, Multiple Linear Regression Models, Linearly Constrained Minimum-Variance Filter

UNIT - 3

Linear Prediction

Forward Linear Prediction, Backward Linear Prediction, Properties of Prediction-Error Filters, Autoregressive Modeling of a Stationary Stochastic Process, Lattice Filter Lattice Recursions, Lattice as **Optimal Filter, Predictive Modeling of Speech**

UNIT - 4

Method of Steepest Descent
Dr. Babasaheb Ambedkar Technological University, Lonere

Steepest Descent Technique, the Steepest Descent Algorithm applied to the Wiener Filter, Stability of the Steepest Descent Algorithm, Example, the Steepest Descent Algorithm as a Deterministic Search Model, Virtue and Limitations of the Steepest Descent Algorithm

UNIT - 5

Least-Mean-Square Adaptive Filters

LMS Algorithm, Least-Mean-Square Adaptation Algorithm, Applications, Statistical LMS Theory, Comparison of the LMS Algorithm with the Steepest Descent Algorithm, Sign LMS Algorithm, Block LMS Algorithm, Fast Implementation of Block LMS Algorithm, Fast Implementation of Block LMS Algorithm

UNIT - 6

Frequency-Domain and Sub band Adaptive Filters

Block-Adaptive Filters, Unconstructed Frequency-Domain Adaptive Filters, Self- Orthogonalizing Adaptive Filters, Subband Adaptive Filters, Classification of Adaptive Filtering Algorithms

TEXT/REFERENCE BOOKS

- 1. "Adaptive Filter Theory" by S. Haykin, Prentice Hall, Englewood Cliffs, NJ, 1991 (end Ed.)
- 2. "Adaptive Filters Theory and Applications", by B. Farhang-Boroujeny, John Wiley and Sons,

1999

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Embedded System Design

8 Credits

UNIT - 1

Introduction to Embedded Computing

Introduction, Overview, Characteristics of Embedding Computing Applications, Concept of Real time Systems, Challenges in Embedded System Design, Design Process: Requirements, Specifications, Architecture Design, Designing of Components, System Integration

UNIT - 2

Embedded System Architecture

Instruction Set Architecture, CISC and RISC instruction set architecture

Basic Embedded Processor/Microcontroller Architecture: CISC Examples (Motorola (68HC11) Example, 8051), RISC Example (ARM), DSP Processors, Harvard Architecture, PIC

Memory System Architecture: Caches, Virtual Memory, Memory Management Unit and Address Translation

I/O Sub-system: Busy-wait I/O, DMA, Interrupt driven I/O, Co-processors and Hardware Accelerators

Dr. Babasaheb Ambedkar Technological University, Lonere

Processor Performance Enhancement: Pipelining, Super-scalar Execution, CPU Power Consumption

UNIT - 3

Designing Embedded Computing Platform

Using CPU Bus: Bus Protocols, Bus Organization

Memory Devices and their Characteristics: RAM, ROM, UVROM, EEPROM, Flash Memory, DRAM **I/O Devices:** Timers and Counters, Watchdog Timers, Interrupt Controllers, DMA Controllers, A/D and D/A Converters, Displays, Keyboards, Infrared devices

Component Interfacing: Memory Interfacing, I/O Device Interfacing

Interfacing Protocols: GPIB, FIREWIRE, USB, IRDA

Designing with Processors: System Architecture, Hardware Design, FPGA Based Design **Implementation:** Development Environment, Debugging Techniques, Manufacturing and Testing **Design Examples:** Data Compressor, Alarm Clock

UNIT - 4

Programming Embedded Systems

Program Design: Design Patterns for Embedded Systems, Models of Program, Control and Data flow Graph

Programming Languages: Desired Language Characteristics, Introduction to Object Oriented Programming, Data Typing, Overloading and Polymorphism, Control, Multi- tasking and Task Scheduling, Timing Specifications, Run-time Exception handling

Use of High Level Languages: C for Programming embedded systems, Object Oriented Programming for Embedded Systems in C++, Use of Java for Embedded Systems Programming and Run-time Environment: Compiling, Assembling, Linking and Debugging, Basic Compilation Techniques, Analysis and Optimization of Execution Time, Analysis and Optimization of Energy and Power, Analysis and Optimization of Program Size, Program Validation and Testing

UNIT - 5

Operating System

Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Coroutines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking

Scheduling: Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling

Inter-process Communication: Signals, Shared Memory Communication, Message-Based Communication

Real-time Memory Management: Process Stack Management, Dynamic Allocation

I/O: Synchronous and Asynchronous I/O, Interrupt Handling, Device Drivers, Real-time Transactions and Files

Example Real-time OS: VxWorks, RT-Linux, Psos

Evaluating and Optimizing Operating System Performance: Response-time Calculation, Interrupt latency, Time-loading, Memory Loading Power Optimization Strategies for Processes

Dr. Babasaheb Ambedkar Technological University, Lonere

UNIT - 6

Embedded System Development

Design Methodologies: UML as Design tool, UML notation, Requirement Analysis and Use case Modeling, Static Modeling, Object and Class Structuring, Dynamic Modeling

Architectural Design: Hardware-Software Partitioning, Hardware-Software Integration

Design Examples: Telephone PBX, Inkjet Printer, PDA, Set-top Box, Elevator Control System, ATM System

Fault-tolerance Techniques, Reliability Evaluation Techniques

Embedded control applications: Introduction, Open-loop and Closed Loop Control Systems,

Examples: Speed Control, PID Controllers: Software Coding of a PID Controller, PID tuning Fuzzy Logic Controller, Application Examples: Washing Machine, Automotive Systems, Auto-focusing digital camera, Air-conditioner

TEXT/REFERENCE BOOKS

- Wayne Wolf "Computers as components : Principles of Embedded Computing System Design", Morgan Kaufman publication 2000
- **2.** Andrew N. Sloss, Dominic Symes, Chris Wright," ARM System Developer's Guide, Designing and Optimizing System Software", Elseveir-2002
- 3. John B. Peatman, "Design with PIC Microcontroller", Pearson Education Asia, 2002
- 4. Tim Wimshurt, "The design of small scale Embedded systems", Palgrave 2003