

**ANNA UNIVERSITY TIRUCHIRAPPALLI****Tiruchirappalli – 620 024****Regulations 2008****Curriculum****B.E. BIOMEDICAL ENGINEERING****SEMESTER III**

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MA1201</b>	Transforms and Partial Differential Equations	3	1	0	4
2	<b>BM1201</b>	Medical Physics	3	0	0	3
3	<b>EC1202</b>	Signals and Systems	3	1	0	4
4	<b>EI1204</b>	Sensors and Measurements	3	1	0	4
5	<b>EC1212</b>	Electronic Circuits	3	1	0	4
6	<b>BM1202</b>	Biochemistry	3	0	0	3
7	<b>BM1203</b>	Anatomy and Human Physiology	3	0	0	3
<b>Practical</b>						
8	<b>BM1204</b>	Biochemistry and Human Physiology Laboratory	0	0	4	2
9	<b>EC1213</b>	Electronic Circuits Laboratory	0	0	3	2
<b>Total</b>						<b>29</b>

**SEMESTER IV**

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MA1253</b>	Probability and Random Processes	3	1	0	4
2	<b>BM1251</b>	Biomedical Instrumentation	3	0	0	3
3	<b>EE1258</b>	Basic Electrical Engineering	3	0	0	3
4	<b>EC1259</b>	Analog and Digital Integrated Circuits	3	1	0	4
5	<b>BM1252</b>	Pathology and Microbiology	3	0	0	3
6	<b>EC1264</b>	Analog and Digital Communication	3	0	0	3
7	<b>HS1201</b>	Environmental Science and Engineering	3	0	0	3
<b>Practical</b>						
8	<b>EC1267</b>	Integrated Circuits Laboratory	0	0	3	2
9	<b>BM1253</b>	Pathology and Microbiology Laboratory	0	0	4	2
<b>Total</b>						<b>27</b>

## SEMESTER V

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>EC1310</b>	Microprocessors and Microcontrollers	3	0	0	3
2	<b>BM1301</b>	Biomechanics	3	0	0	3
3	<b>EC1311</b>	Digital Signal Processing	3	1	0	4
4	<b>BM1302</b>	Bio Control Systems	3	1	0	4
5	<b>BM1303</b>	Biomaterials and Artificial Organs	3	0	0	3
6	<b>BM1304</b>	Bioinformatics	3	0	0	3
<b>Practical</b>						
7	<b>EC1312</b>	Microprocessors and Microcontrollers Laboratory	0	0	3	2
8	<b>BM1305</b>	Biomedical Instrumentation Laboratory	0	0	3	2
9	<b>BM1306</b>	Digital Signal Processing Laboratory	0	0	3	2
<b>Total</b>						<b>26</b>

## SEMESTER VI

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>CS1357</b>	Digital Image Processing	3	0	0	3
2	<b>BM1351</b>	Radiological Equipments	3	0	1	4
3	<b>BM1352</b>	Diagnostic and Therapeutic Equipments I	3	0	1	4
4	<b>CS1361</b>	Object Oriented Programming and Java	3	0	0	3
5	<b>E1****</b>	Elective I	3	0	0	3
6	<b>E2****</b>	Elective II	3	0	0	3
<b>Practical</b>						
7	<b>CS1362</b>	Digital Image Processing Laboratory	0	0	3	2
8	<b>CS1363</b>	Object Oriented Programming Laboratory	0	0	3	2
9	<b>HS1301</b>	Communication and Soft Skills Laboratory	0	0	3	2
<b>Total</b>						<b>26</b>

## SEMESTER VII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>MG1301</b>	Total Quality Management	3	0	0	3
2	<b>CS1404</b>	Pattern Recognition and Neural Networks	3	0	0	3
3	<b>CS1405</b>	Internet Programming	3	1	0	4
4	<b>BM1401</b>	Diagnostic and Therapeutic Equipments II	3	0	0	3
5	<b>E3****</b>	Elective III	3	0	0	3
6	<b>E4****</b>	Elective IV	3	0	0	3
<b>Practical</b>						
7	<b>BM1402</b>	Hospital Training**	0	0	4	2
8	<b>BM1403</b>	Diagnostic and Therapeutic Equipments Laboratory	0	0	3	2
9	<b>CS1406</b>	Internet Programming Laboratory	0	0	3	2
<b>Total</b>						<b>25</b>

\*\* No Examination

## SEMESTER VIII

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>BM1451</b>	Hospital Management	3	0	0	3
2	<b>BM1452</b>	Medical Optics	3	0	0	3
3	<b>E5****</b>	Elective V	3	0	0	3
4	<b>E6****</b>	Elective VI	3	0	0	3
<b>Practical</b>						
5	<b>BM1455</b>	Project Work	0	0	12	6
<b>Total</b>						<b>18</b>

## ELECTIVES ODD SEMESTER

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>EC1022</b>	Analog and Digital Communication	3	0	0	3
2	<b>GE1001</b>	Intellectual Property Rights (IPR)	3	0	0	3
3	<b>GE1002</b>	Indian Constitution and Society	3	0	0	3
4	<b>CS1020</b>	Soft Computing	3	0	0	3
5	<b>BM1001</b>	Physiological Modeling	3	0	0	3
6	<b>BM1002</b>	Medical Informatics	3	0	0	3
7	<b>BM1003</b>	Refrigeration and Air-Conditioning	3	0	0	3

## ELECTIVES EVEN SEMESTER

S.No.	Subject Code	Subject	L	T	P	C
<b>Theory</b>						
1	<b>BM1004</b>	Biofluids and Dynamics	3	0	0	3
2	<b>BM1005</b>	Tele-Health Technology	3	0	0	3
3	<b>BM1006</b>	Assist Devices	3	0	0	3
4	<b>EC1023</b>	VLSI Design	3	0	0	3
5	<b>CS1035</b>	Computer Networks	3	0	0	3
6	<b>BM1007</b>	Rapid Prototyping	3	0	0	3
7	<b>GE1301</b>	Professional Ethics and Human values	3	0	0	3
8	<b>BM1008</b>	Nano Electronics	3	0	0	3
9	<b>CS1036</b>	Data Structures	3	0	0	3

# ANNA UNIVERSITY TIRUCHIRAPPALLI

Tiruchirappalli – 620 024

Regulations 2008

Syllabus

## B.E. BIOMEDICAL ENGINEERING

### SEMESTER III

#### MA1201 – TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

(Common to all branches of BE / B.Tech Programmes)

L	T	P	C
3	1	0	4

#### UNIT I      **FOURIER SERIES**      9

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

#### UNIT II      **FOURIER TRANSFORMS**      9

Fourier integral theorem (Without Proof) – Fourier transform pair – Sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

#### UNIT III      **PARTIAL DIFFERENTIAL EQUATIONS**      9

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

#### UNIT IV      **APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**      9

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

#### UNIT V      **Z -TRANSFORMS AND DIFFERENCE EQUATIONS**      9

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

**L: 45 T: 15 Total: 60**

**TEXT BOOKS**

1. Grewal, B.S., “Higher Engineering Mathematics”, 4th Edition, Khanna Publishers, 2007.
2. Bali, N.P. and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications Private Ltd, 2008.

**REFERENCES**

1. Ramana, B.V., “Higher Engineering Mathematics”, 2nd Edition, TMH Publishing Company Limited, 2008.
2. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2008.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2008.

## BM1201 – MEDICAL PHYSICS

L	T	P	C
3	0	0	3

### UNIT I ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATIONS 9

Light – Physics of light – Intensity of light – Limits of vision and color vision – Sound – Physics of sound – Normal sound levels – Ultrasound fundamentals – Generation of ultrasound (Ultrasound transducer) – Interaction of ultrasound with materials – Reflection and refraction – Absorption and scattering – Non-ionizing electromagnetic radiation tissue as a leaky dielectric – Relaxation processes – Overview of non- ionizing radiation effects – Low frequency effect – High frequency effect.

### UNIT II RADIOACTIVE AND ITS TYPES 9

Radioactive decay – Spontaneous emission – Isometric transition – Gamma ray emission – Alpha – Beta – Positron decay – Electron capture principles of nuclear physics – Natural radioactivity – Decay series – Half life period – Type of radiation and their applications – Production of radio nuclides – Cyclotron produced radionuclide – Reactor produced radionuclide – Fission and electron capture reaction – Radionuclide generator – Milking process – Linear accelerator – Radionuclide used in medicine and technology.

### UNIT III INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter – Specific ionization – Linear energy transfer range – Bremsstrahlung – Annihilation interaction of gamma radiations with matter – Photoelectric effect – Compton scattering – Pair production – Attenuation of gamma radiation – Interaction of neutron with matter.

### UNIT IV PHYSICS OF CARDIOPULMONARY SYSTEM 9

The airways – Blood and lung interaction – Measurement of lung volume – Pressure Air flow volume relationships of lungs – Physics of alveoli – The breathing mechanism – Major components of cardiovascular system – O<sub>2</sub> and CO<sub>2</sub> exchange in the capillary system – Physical activity of heart – Transmural pressure – Bernolli's principles applied to cardiovascular system – Blood flow – Laminar and turbulent.

### UNIT V RADIATION EFFECTS 9

Acute radiation effects – The concept of LD<sub>50</sub> – Radiation syndromes – Central nervous system syndrome – Gastro-intestinal syndrome – Bone marrow syndrome – Delayed effects of radiation – Stochastic and deterministic effects – Late deterministic effect in different organs and tissues.

**Total: 45**

## **TEXT BOOKS**

1. Brown, B.H., Law Ford, P., Small Wood, V. R.H., Hose, D.R. and Barber, D.C. “Medical Physics and Biomedical Engineering”, CRC Press, 3rd Edition 1999.
2. Gopal B. Saha, “Physics and Radiobiology of Nuclear Medicine” 3rd Edition, Springer, 2006.

## **REFERENCES**

1. John R. Cameron and James G. Skofronick, “Medical Physics”, 3rd Edition, John–Wiley and Sons, 1978.
2. Farr, R. F. and Allisy Roberts, P.J., “Physics for Medical Imaging”, 3rd Edition, Saunders, 1997.
3. Uma Devi, P., Nagarathnam, A. Satish Rao, B.S., “Introduction to Radiation Biology”, 3rd Edition, B. I. Churchill Livingstone Pvt Ltd, 2000.

## EC1202 – SIGNALS AND SYSTEMS

**L T P C**  
**3 1 0 4**

### **UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9**

Continuous time signals (CT Signals) – Discrete time signals (DT Signals) – Step –Ramp – Pulse – Impulse – Exponential – Classification of CT and DT signals – Periodic and aperiodic – Random signals – CT systems and DT systems – Basic properties of systems – Linear time invariant systems and properties.

### **UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9**

Fourier series analysis – Spectrum of C .T. signals – Fourier transform and laplace transform in signal analysis.

### **UNIT III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS 9**

Differential equation – Block diagram representation – Impulse response – Convolution integral – Frequency response – Fourier and laplace transforms in analysis – State variable equations and matrix representation of systems.

### **UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9**

Sampling of CT signals and aliasing – DTFT and properties – Z-transform and properties of Z-transform.

### **UNIT V LINEAR TIME INVARIANT - DISCRETE TIME SYSTEMS 9**

Difference equations – Block diagram representation – Impulse response – Convolution sum – LTI systems analysis using DTFT and Z-transforms – State variable equations and matrix representation of systems.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Allan V. Oppenheim, Wilsky, S. and Nawab, S.H., “Signals and Systems”, 8th Edition, Pearson Education, 2007.
2. Ramakrishna Rao, P., “Signals and Systems”, 5th Edition, TMH, 2008

### **REFERENCES**

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, John Wiley and Sons, 2004.
2. Robert A. Gabel and Richard A. Roberts, “Signals and Linear Systems”, 3rd Edition, John Wiley, 1987.
3. Rodger E. Ziemer, William H. Tranter, Ronald Fannin, D., “Signals and Systems”, 4th Edition, Pearson Education, 2002.

## EI1204 – SENSORS AND MEASUREMENTS

**L T P C**  
**3 1 0 4**

### **UNIT I SCIENCE OF MEASUREMENTS 8**

Measurement system – Instrumentation – Classification and characteristics of transducers – Static and dynamic – Errors in measurements – Calibration – Primary and secondary standards.

### **UNIT II DISPLACEMENT, PRESSURE, TEMPERATURE SENSORS 10**

Strain gauge: Gauge factor – Sensing elements – Configuration – Unbounded strain gage – Biomedical applications – Strain gauge as displacement and pressure transducers – Force summing devices – Capacitive transducer – Inductive transducer – Linear variable differential transducer – Passive types – RTD materials and range – Relative resistance Vs. Temperature characteristics – Thermistor characteristics – Biomedical applications of Temperature sensors – Active type: Thermocouple – Characteristics.

### **UNIT III PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS 9**

Phototube – Photo multiplier tube – Photovoltaic – Photoconductive cells – Photo diodes – Phototransistor – Comparison of photoelectric transducers – Spectro-photometric applications of photo electric transducers – Piezoelectric active transducer and biomedical applications as pressure and ultrasound transducer.

### **UNIT IV SIGNAL CONDITIONING and SIGNAL ANALYSER 9**

AC and DC bridges – Wheat stone bridge – Kelvin – Maxwell – Hay – Schering – Pre-Amplifier – Impedance matching circuits – Isolation amplifier – Spectrum analyzer.

### **UNIT V DISPLAY AND RECORDING DEVICES 9**

Digital voltmeter – Multi meter – CRO – Block diagram, CRT – Vertical and horizontal deflection system – DSO – LCD monitor – PMMC writing systems – Servo recorders – Photographic recorder – Magnetic tape recorder – X–Y recorder – Thermal recorder.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Geddas, L.A. and Baker, L. E., “Principles of Applied Biomedical Instrumentation”, 3rd Edition, John Wiley and Sons, 1989.
2. Albert D. Helfrick and William D.Cooper “Modern Electronic Instrumentation and Measurement Techniques”, 4th Edition, Prentice Hall of India, 2007.

### **REFERENCES**

1. Ernest O. Doebelin and Dhanesh N. Manik, “Measurement Systems, Application and Design”, 5th Edition, Tata McGraw-Hill, 2007.
2. Khandpur, R.S., “Handbook of Biomedical Instrumentation”, 2nd Edition, Tata McGraw-Hill, 2007.
3. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, 3rd Edition, Prentice Hall of India, 2007.

## EC1212 – ELECTRONIC CIRCUITS

**L T P C**  
**3 1 0 4**

### **UNIT I DIODE APPLICATIONS AND TRANSISTOR BIASING 9**

Rectifiers – HWR – FWR – Bridge rectifier with and without capacitor and pie filter– Clipper – Clampers – Voltage multiplier circuits – Operating point of the bi-polar junction transistor – Fixed bias circuit – Transistor on saturation – Emitter stabilized bias circuit – Voltage divider bias – Transistors switching network – Trouble shooting the transistor (In circuit testing) – Practical applications – Biasing the FET transistors - CMOS devices – MOSFET handling.

### **UNIT II SMALL SIGNAL AMPLIFIERS 9**

Two port network – H-parameter model – Small signal analysis of BJT (CE and CC configurations only) – High frequency model of BJT – (CE Configuration Only) - Small signal analysis of JFET (CS Configuration Only) - Frequency response of BJT and FET.

### **UNIT III FEEDBACK AMPLIFIER AND OSCILLATORS 9**

Basic of feedback system (Block diagram approach) – Types of feedback amplifier – Basic principles of oscillator – Audio oscillators – RC phase shift and wein bridge oscillator – RF oscillators – Hartly and collpit oscillator – Crystal oscillator – Multivibrators.

### **UNIT IV POWER AMPLIFIERS 9**

Definition – Types of power amplifiers – Class A (Series Fed – Transformer Coupled )- Class B amplifier – Class-B push-pull amplifier – Complimentary symmetry type - Class-C amplifier – Heat sink .

### **UNIT V VOLTAGE REGULATIONS 9**

Shunt voltage regulator – Series voltage regulator – Current limiting – Feedback technique – SMPS (Block diagram approach) – DC to DC converter – Three terminal IC regulators (78XX And 79XX).

**L : 45 T : 15 Total: 60**

### **TEXT BOOK**

1. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory”, 6th Edition, Prentice Hall of India, 2004.

### **REFERENCES**

1. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, 2008.
2. Millman Haykins, “Electronic Devices and Circuits”, 2nd Edition, Tata McGraw Hill, 2007.

## **BM1202 – BIOCHEMISTRY**

**L T P C**  
**3 0 0 3**

### **UNIT I BIOMOLECULE STRUCTRES 6**

Basics of Biochemistry – Biomolecules – Structure of Water and its Importance – Important Noncovalent Forces – Hydrogen Bonds – Electrostatic – Hydrophobic and Vanderwaals Forces – Acid – Base and Buffers – pH – Henderson Hasselbalch Equation – Biological Buffers and their Significance – Principle of Viscosity – Surface Tension – Adsorption – Diffusion – Osmosis and their Applications in Biological Systems.

### **UNIT II STUDY OF AMINO ACIDS, LIPIDS AND NUCLIC ACIDS 9**

Classification – Structure and Properties of Carbohydrates – Mono – Di – Oligo and Polysaccharides – Classification – Structure and Properties of Amino Acids and Proteins – Classification – Structure and Properties of Lipids – Simple Lipids – Phospholipids – Glycolipids and Steroids – Transport of Lipids: Lipoproteins Structure and Functions of Nucleic Acids – Nucleosides – Nucleotides – Cyclic AMP – Cyclic GMP – ATP – GTP – DNA and RNA.

### **UNIT III ENZYMES AND METABOLISM 12**

Classification of Enzymes – Chemical Nature – Active Site – Specificity of Enzyme Catalyzed Reactions – Regulation : Feedback – Allosteric – Covalent Modification – Hormonal Regulation – Co-enzymes – Assay of Enzymes – Enzymes in Clinical Diagnosis of Diseases – Basics of Metabolism – Carbohydrate Metabolism – Glycolysis Lipid Metabolism – Fatty Acid – Beta Oxidation – Ketogenesis and Cholesterol Metabolism – TCA Cycle – Structure of Biological Membranes – Electron Transport and Oxidative Phosphorylation.

### **UNIT IV FUNCTIONS OF LIVER, KIDNEY and HARMONES 9**

Liver Function and Liver Function Tests – Kidney Function and Kidney Function Tests – Normal and Abnormal Constituents of Urine and their Clinical Significance – General Characteristics of Hormones – Structure – Functions and Disorders of Thyroid – Parathyroid – Pituitary – Adrenal and Pancreatic Hormones – Hormones as Chemical Messengers: General Assay of Hormones – Bio Assay – Chemical Assay and Immuno Assays.

### **UNIT V ELECTROPHORESIS AND CHROMATOGRAPHY 9**

Analytical Techniques: Principle and Applications of Electrophoresis – PAGE – SDS PAGE – Isoelectric Focusing – Two Dimensional Electrophoresis – Chromatography: Principle of Adsorption and Partition Chromatography – Size Exclusion – Ion Exchange and Affinity Chromatography – Spectro Photometry – Fluorimetry – Flame Photometry – Manometry – Microcalorimetry – Electrochemical Methods – Biosensors – Automation in Clinical Laboratory – Use of Radio Isotopes in Biochemistry.

**Total:45**

## **TEXT BOOKS**

1. David W. Martin, Peter A. Mayes, Victor W. Rodwell, "Harper's Review of Biochemistry", 20th Edition, Lange Medical Publications, 2003.
2. Keith Wilson and John Walker, "Practical Biochemistry – Principles and Techniques", 5th Edition, Oxford University Press, 2003.

## **REFERENCES**

1. Trevor Palmer, "Understanding Enzymes", 3rd Edition, Ellis Horwood Ltd, 1991.
2. Pamela C. Champe and Richard A. Harvey, "Biochemistry Lippincott's Illustrated Reviews", 3rd Edition, Lippincott-Raven Publishers, 2006.

## **BM1203 – ANATOMY AND HUMAN PHYSIOLOGY**

**L T P C**  
**3 0 0 3**

### **UNIT I STUDY OF CELLULAR SYSTEM 8**

Cell – Structure and organelles – Functions of each component in the cell – Cell membrane – Transport across membrane – Origin of cell membrane potential (Nernst and Goldman and Katz Equations) – Action potential.

### **UNIT II HEMATOLOGICAL SYSTEM 9**

Blood composition – Functions of blood – Functions of RBC – WBC types and their functions – Blood groups – Importance of blood groups – Identification of blood groups – Blood flow factors regulating blood flow such as viscosity – Radius – Density etc., (Fahreus Lindqvist Effect, Poiseuille's Law ).

### **UNIT III RENAL AND RESPIRATORY SYSTEM 9**

Structure of kidney and nephron – Mechanism of urine – Formation and acid base Regulation – Dialysis – Components of respiratory system – Oxygen and carbon dioxide transport and acid base regulation.

### **UNIT IV CARDIAC SYSTEM 9**

Structure of heart – Properties of cardiac muscle – Cardiac muscle and pacemaker potential – Cardiac cycle – ECG – Heart sound – Volume and pressure changes and regulation of heart rate.

### **UNIT V SENSORY SYSTEM 10**

Structure of a neuron – Synaptic conduction – Conduction of action potential in neuron parts of brain cortical localization of functions – EEG – Simple reflexes – Withdrawal reflexes – Autonomic nervous system and its functions – Structure of eye – Ear and auditory and visual pathways.

**Total: 45**

### **TEXT BOOK**

1. Elaine N. Marieb, “Essential of Human Anatomy and Physiology”, 8th Edition, Pearson Education, 2007.

### **REFERENCES**

- 1 William F. Ganong, “Review of Medical Physiology”, 22nd Edition, Tata Mc Graw Hill, 2005.
- 2 Jain, A. K., “Text book of Physiology”, 3rd Edition, Vol. I and II, Avichal Publishing Company,

**BM1204 – BIOCHEMISTRY AND HUMAN PHYSIOLOGY  
LABORATORY**

**L T P C**  
**0 0 4 2**

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
4. Estimation of serum cholesterol.
5. Assay of SGOT/SGPT.
6. Estimation of creatinine in urine.
7. Electrophoresis of serum proteins.
8. Separation of amino acids using thin layer chromatography.
9. ESR, PCV, MCH, MCV, MCHC, total count of RBCs and Hemoglobin estimation
10. Differential count of different WBCs and Blood group identification.
11. Ishihara chart for color blindness and Snellen's chart for myopia and hyperopia – by letters reading and ophthalmoscope to view retina.
12. Weber's and Rinnee's test for auditory conduction.

**Total:45**

## EC1213 – ELECTRONIC CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

1. Rectifiers – HWR and FWR (with and without capacitor filter).
2. Zener diode as regulator.
3. Study of biasing circuits
  - i) Fixed bias
  - ii) Self bias
  - iii) Collector to base bias.
4. FET amplifier.
5. Differential amp – CMRR and determination of Gain.
6. Design of RC coupled amplifier.
7. Design of Voltage series feedback amplifier.
8. Design of Class A and Class B amplifier.
9. Design of RC phase shift oscillator.
10. Design of Hartley Oscillator.
11. Design of Colpitt oscillator.
12. Study of pulse shaping circuits
  - i). Astable Multivibrator.
  - ii). Monostable Multivibrator.

**Total: 45**

## SEMESTER IV

### MA1253 – PROBABILITY AND RANDOM PROCESSES

(Common to ECE and Biomedical)

**L T P C**  
**3 1 0 4**

#### **UNIT I RANDOM VARIABLES 9**

Discrete and continuous random variables – Moments – Moment generating functions and their properties – Binomial – Poisson – Geometric – Uniform – Exponential – Gamma and normal distributions – Function of random variable.

#### **UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables – Central limit theorem (For IID Random Variables).

#### **UNIT III CLASSIFICATION OF RANDOM PROCESSES 9**

Definition and examples – First order – Second order – Strictly stationary – Wide-sense stationary and Ergodic process – Markov process – Binomial – Poisson and Normal process – Sine wave process – Random telegraph process.

#### **UNIT IV CORRELATION AND SPECTRAL DENSITY 9**

Auto correlation – Cross correlation – Properties – Power spectral density – Cross spectral density – Properties – Wiener-Khinchine relation – Relationship between cross power spectrum and cross correlation function .

#### **UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9**

Linear Time Invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of Input and Output – White Noise.

**L: 45 T: 15 Total: 60**

#### **TEXT BOOKS**

1. Oliver C. Ibe, “Fundamentals of Applied Probability and Random Processes”, 1st Indian Reprint, Elsevier, 2007.
2. Peebles Jr, P.Z., “Probability Random Variables and Random Signal Principles”, 4th Edition, TMH Publishers, 2002.

#### **REFERENCES**

1. Miller, S.L. and Childers, S.L., “Probability and Random Processes with Applications to Signal Processing and Communications”, 1st Indian Reprint, Elsevier Inc., 2007.
2. Stark, H. and Woods, J.W., “Probability and Random Processes with Applications to Signal Processing”, 3rd Edition, Pearson Education, 2002.
3. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, 8th Edition, TMH, 2004.

## BM1251 – BIOMEDICAL INSTRUMENTATION

L T P C  
3 0 0 3

### UNIT I BIO POTENTIAL ELECTRODES 9

Origin of Bio-potential and its propagation – Electrode – Electrolyte interface – Electrode – Skin interface – Half cell potential – Impedance – Polarization effects of electrode – Nonpolarizable electrodes – Types of electrodes – Surface – Needle and micro electrodes and their equivalent circuits – Recording problems – Measurement with two electrodes.

### UNIT II ELECTRODE CONFIGURATIONS 9

Biosignals characteristics – Frequency and amplitude ranges – ECG – Einthoven's triangle – Standard 12 lead system – EEG – 10-20 Electrode system – Unipolar – Bipolar and Average Mode – EMG, ERG and EOG – Unipolar and bipolar mode.

### UNIT III BIO AMPLIFIER 8

Need For Bio-Amplifier – Single ended Bio-Amplifier, Differential Bio-Amplifier – Right leg driven ECG amplifier – Band pass filtering – Isolation amplifiers – Transformer and optical isolation – Isolated DC amplifier and AC carrier amplifier – Chopper amplifier – Power line interference.

### UNIT IV MEASUREMENT OF NON-ELECTRICAL PARAMETER 10

Temperature – Respiration rate and pulse rate measurements – Blood pressure: Indirect methods – Auscultatory method – Oscillometric method – Direct methods – Electronic manometer – Pressure amplifiers – Systolic, diastolic – Mean detector circuit – Blood flow and cardiac output measurement – Indicator dilution – Thermal dilution and Dye dilution method – Electromagnetic and ultrasound blood flow measurement.

### UNIT V BIO-CHEMICAL MEASUREMENT 9

Biochemical sensors – Ph – Po<sub>2</sub> and Pco<sub>2</sub> – Ion Selective Field Effect Transistor (ISFET) – Immunologically Sensitive FET (IMFET) – Blood glucose sensors – Blood gas analyzers – Colorimeter – Flame photometer – Spectrophotometer – Blood cell counter – Auto analyzer (Simplified schematic description).

**Total: 45**

### TEXT BOOKS

1. Carr, J.J. and Brown, J.M., "Introduction to Biomedical Equipment Technology", 4th Edition, Pearson Education, 2004.
2. Webster, J.G., "Medical Instrumentation Application and Design", 3rd Edition, John Wiley and sons, 2004.

### REFERENCES

1. Cromwell, L., "Biomedical Instrumentation and Measurement", 3rd Edition, Prentice Hall of India, 2007.
2. Khandpur, R.S., "Handbook of Biomedical Instrumentation", 8th Edition, Tata McGraw-Hill, 2003.
3. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", 4th Edition, Tata McGraw-Hill, 2003.

## EE1258 – BASIC ELECTRICAL ENGINEERING

**L T P C**  
**3 0 0 3**

### **UNIT I MAGNETIC CIRCUIT 9**

Magnetic effects of electric current – Magnetic circuits – Magnetic materials and B-H relationship – Electromagnetic induction and force – Hysteresis and eddy current losses.

### **UNIT II DC MOTORS 9**

Parts of DC motors – Types of motors – Principle of operation of DC motors – Back EMF – Circuit model – Power balance – Calculation of torque and speed– Armature and field control – DC motor starting – Calculation of efficiency.

### **UNIT III TRANSFORMERS 9**

Methods of generation of AC voltages – Role of transformers in the distribution of electricity – Construction and principle of operation of single phase transformers – Ideal transformer – Voltage and current relationships – Impedance transformation – Definition of voltage regulation – Losses in transformer – Calculation of efficiency of transformer – Construction and voltage ratio aspects of single phase autotransformer – Construction and voltage ratio aspects of three phase transformer.

### **UNIT IV AC MACHINES 9**

Synchronous machines – Construction – Principle of operation – Phasor diagram – Voltage equation – Open circuit and short circuit characteristics – Voltage regulation – Induction motor – Construction – Circuit model – Torque slip characteristics – Starting – Speed control – Slip control – Frequency control.

### **UNIT V FRACTIONAL - KW MOTORS 9**

Single phase induction motor – Principle of operation – Torque speed characteristics – Two-phase motors – Split phase motor – Universal motor – Two value capacitance motor – Stepper motors – Variable reluctance stepper motor – Single stack and multistack – Permanent magnet stepper motor – Drive concepts – Unipolar drive circuit – Bipolar drive circuit – Calculation.

**Total: 45**

### **TEXT BOOKS**

1. Kothari, D.P. and Nagrath, I.J., “Basic Electrical Engineering”, 2nd Edition, TMH, 2007.
2. Sen, P.C., “Principles of Electric Machines and Power Electronics”, 2nd Edition, John-Wiley and Sons, 2007.

### **REFERENCES**

1. Muhammad Rashid, “Power Electronics Circuit, Devices and Applications”, 3rd Edition, Prentice Hall of India, 2004.
2. Dubey, “Thyristorised Power Controllers”, Wiley Eastern 1986.

## EC1259 – ANALOG AND DIGITAL INTEGRATED CIRCUITS

**L T P C**  
**3 1 0 4**

### **UNIT I OPERATIONAL AMPLIFIERS 9**

Characteristics of ideal operational amplifier – Slew rate – Offset voltage – Bias current – CMRR – Bandwidth – Equivalent circuit of an OP-AMP – Virtual ground concept – Linear applications of OP-AMP – Inverting and Non-inverting amplifier – Summer – Subtractor – Averaging amplifier – Voltage to current converter – Current to voltage converter – Differential amplifiers – Differentiator and integrator – Nonlinear applications – Comparator – Schmitt triggers – Precision diode half wave and full wave rectifiers – Average detectors – Peak detector.

### **UNIT II ACTIVE FILTERS AND SIGNAL GENERATOR 9**

Active filters (First and second order) – Low pass – High pass – Band pass filters – Band reject filters (Notch filters) – Oscillators – RC phase shift and Wein-Bridge – Waveform generators – Square – Triangular and Saw-tooth.

### **UNIT III TIMER, PLL, A/D AND D/A CONVERTERS 9**

555 Timer (Internal diagram) and its applications – Monostable multivibrator – Astable multivibrator – Phase locked loop (565-Block diagram approach) and its applications – Frequency multiplication – Frequency translation – Voltage to frequency and frequency to voltage converters – DAC – Binary weighted DAC and R – 2R DAC – ADC – Single slope and dual slope ADC's successive approximation ADC.

### **UNIT IV NUMBER SYSTEMS AND LOGIC GATES 9**

Decimal – Binary – Octal and Hexa-decimal numbers – Conversion between these number systems – Complements R's and (R-1)'s complement – Subtraction using complements – Encoding numbers and characters using binary digits – Binary coded decimal – Gray code – Binary to gray code conversion – ASCII code – Logic gates – Truth tables – NOT– AND – OR – NOR – NAND – XOR – XNOR – Boolean laws and theorems – Solving boolean expressions – Truth tables and logic circuits – The Karnaugh map – Half adder – Full adder – Multiplexers and demultiplexers – Decoders and encoders – Coding of combination circuits in verilog.

### **UNIT V REGISTERS AND COUNTERS 9**

Flip Flops – RS – D – T – JK flip flops – Characteristic equations – Exciting tables – JK master – Slave Flip-Flop – Universal shift register – Design of Modulo-n counters – Counter design using state diagram – Sequential circuit design with verilog.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. Gayakwad , R.A., “OP-AMP and Linear ICs”, 3rd Edition, Prentice Hall of India, 1994.
2. Morris Mano, M., “Digital Logic and Computer Design”, 2nd Edition, Prentice Hall of India, 1994.

### **REFERENCES**

1. Northrop, R.B., “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, 2nd Edition, CRC Press, 2004.
2. Wakerly, J.F., “Digital Design Principles and Practices”, 4th Edition, Pearson Education, 2007.
3. Roth Jr, C.H., “Fundamentals of Logic Design”, 4th Edition, Jaico Books, 2002.

## BM1252 – PATHOLOGY AND MICROBIOLOGY

**L T P C**  
**3 0 0 3**

### **UNIT I STUDY OF CELLS 9**

Cell degeneration – Repair and neoplasia – Cell injury and necrosis – Apoptosis – Intracellular accumulations – Pathological calcification – Cellular adaptations of growth and differentiation – Inflammation and repair including fracture healing – Neoplasia – classification – Benign and malignant tumours – Carcinogenesis – Spread of tumours.

### **UNIT II INTRAVASCULAR COAGULATION 9**

Fluid and hemodynamic derangement – Edema – Normal hemostasis – Thrombosis – Disseminated intravascular coagulation – Embolism – Infarction – Shock – Hematological disorders – Bleeding disorders – Leukaemias – Lymphomas.

### **UNIT III STRUCTURE OF BACTERIA AND VIRUS 9**

General structural organisation of bacterial and viral cell – Growth and identification of bacteria – Observation of culture – Microscopy – Light microscopy – Dark field microscopy – Phase contrast microscopy – Fluorescence and electron microscopy.

### **UNIT IV IMMUNITY AND IMMUNE RESPONSE 9**

Genetic disorders – Infection and immunity – Mutations – Autosomal and X linked disorders – Mendelian disorders – Types of immune response – Hypersensitivity disorders – Immune deficiency syndrome – Viral disease – Chlamydial – Bacterial – Mycoplasma – Rickettsial – Fungal – Protozoal and helminthic disease.

### **UNIT V DISEASE PRODUCING ORGANISMS 9**

Identification of disease producing organisms – Simple stain – Gram stain – AFB stain – Fluorescent techniques – Antigen – Antibody techniques.

**Total: 45**

### **TEXT BOOKS**

1. Cotran, R.S., Vinay Kumar and Robbins, S.L., “Pathologic Basis of Diseases”, 7th Edition, WB Saunders Co, 2005.
2. Ananthanarayanan, R. and Panicker, C.K.J., “Textbook of Microbiology”, 7th Edition, Orient Longmans, 2006.

### **REFERENCES**

1. Underwood, J.C.E., “General and Systematic Pathology”, 3rd Edition, Churchill Livingstone, 2000.
2. Prescott, Harley and Klein, “Microbiology”, 5th Edition, Tata McGraw Hill, 2002.
3. Kanika Sharma, “Manual of Microbiology Tools and Techniques”, 1st Edition, Ane’s Student Edition, 2007.

## EC1264 – ANALOG AND DIGITAL COMMUNICATION

**L T P C**  
**3 0 0 3**

### **UNIT I ANALOG MODULATION 9**

Amplitude modulation – AM – DSBSC – SSBSC – VSB – PSD – Modulators and demodulators – Angle modulation – PM and FM – PSD – Modulators and demodulators – Super heterodyne receivers.

### **UNIT II PULSE MODULATION 9**

Low pass sampling theorem – Quantization – PAM – Line coding – PCM – DPCM – DM – ADPCM and ADM – Channel vocoder – Time Division Multiplexing(TDM) – Frequency Division Multiplexing(FDM).

### **UNIT III DIGITAL MODULATION AND TRANSMISSION 9**

Phase Shift Keying (PSK) – BPSK, DPSK, QPSK – Principles of M-ary signaling – M-ary PSK and QAM – Comparison – ISI – Pulse shaping – Duo binary encoding – Cosine filters – Eye pattern – Equalizers

### **UNIT IV INFORMATION THEORY AND CODING 9**

Measure of information – Entropy – Source coding theorem – Shannon-Fano coding – Huffman coding – LZ coding – Channel capacity – Shannon-Hartley law – Shannon's limit – Error control codes – Cyclic codes – Syndrome calculation – Convolutional coding, sequential and viterbi decoding.

### **UNIT V SPREAD SPECTRUM AND MULTIPLE ACCESS 9**

PN Sequences – Properties – M-Sequence – DSSS – Processing gain – Jamming – FHSS – Synchronization and tracking – Multiple access – FDMA, TDMA, CDMA.

**Total:45**

### **TEXT BOOKS**

1. Taub, H., Schilling, D.L. and Saha, G., "Principles of Communication Systems" 3rd Edition, TMH, 2007.
2. Haykin, S., "Digital Communications", 4th Edition, John Wiley, 2005.

### **REFERENCES**

1. Lathi, B. P., "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007
2. Hsu, H.P., Schaum Outline Series "Analog and Digital Communications", 3rd Edition, TMH, 2006.
3. Sklar, B., "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2007.

## HS1201 – ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

### UNIT I IMPORTANCE OF ENVIRONMENTAL STUDIES 9

Scope and importance – Need for public awareness – Forest resources – Water resources – Mineral resources – Land resources – Energy resources – Food resources – Equitable use of resources for sustainable lifestyles.

### UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of ecosystem – Structure and function of an ecosystem – Energy flow in the ecosystem – Food chains – Food webs – Ecological Pyramids – Definition of biodiversity – Biogeographical classification in India – Value of biodiversity – Biodiversity at global – National and local levels – India as a mega diversity nation – Hot spots of biodiversity – Threats to biodiversity – Conservation of biodiversity.

### UNIT III ENVIRONMENTAL POLLUTION 9

Causes and effects of environmental pollution – Air pollution – Water pollution – Soil pollution – Marine pollution – Noise pollution – Thermal pollution – Nuclear hazards – Solid waste management – Societal role in pollution prevention – Environmental disasters and management.

### UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Unsustainable to sustainable development – Concept of conservation – Water and energy conservation – Rain water harvesting – Climate change – Global warming – Acid rain – Ozone layer depletion – Nuclear accidents and holocaust – Environmental protection act – Issues involved in enforcement of environmental legislation – Public awareness.

### UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth – Population explosion – Family welfare programme – Environment and human health – Human rights – Value education – HIV / AIDS – Women and child welfare – Role of IT in Environment and human health.

**Total: 45**

#### TEXT BOOKS

1. Venugopala Rao, P., “Principles of Environmental Science and Engineering”, Prentice Hall of India, 2006.
2. Masters, G.M., “Introduction to Environmental Engineering and Science”, 3rd Edition, Prentice Hall of India, 2007.

#### REFERENCES

1. Davis, M.L. and Masten, S.J., “Principles of Environmental Engineering and Science”, McGraw-Hill, 2004.
2. Bharucha, E., “Text book of Environmental Studies”, University Press, 2005.
3. Trivedi, R.K., “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards”, Vol. I and II, Enviro Media, 1996.

## EC1267 – INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	2

1. Inverting, non-inverting amplifier and comparator.
2. Integrator and Differentiator.
3. Active filter – first order LPF and HPF.
4. Schmitt trigger using IC741.
5. Instrumentation amplifier using IC741.
6. Wein bridge oscillator.
7. Multivibrator using IC555 Timer.
8. Study of logic gates, Half adder and Full adder.
9. Encoder and BCD to 7 segment decoder.
10. Multiplexer and Demultiplexer using digital ICs.
11. Universal shift register using flipflops.
12. Design of Mod-n counter.

**Total: 45**

## **BM1253 – PATHOLOGY AND MICROBIOLOGY LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Hematoxylin and eosin staining.
3. Study of parts of compound microscope
4. Histopathological slides of benign and malignant tumours.
5. Manual tissue processing and section cutting (demonstration)
6. Simple stain.
7. Gram stain.
8. AFB stain.
9. Slides of malarial parasites, micro filaria and leishmania donovani.
10. Haematology slides of anemia and leukemia
11. Bleeding time and clotting time.
12. Study of bone marrow charts

**Total: 45**

## SEMESTER V

### EC1310 – MICROPROCESSORS AND MICROCONTROLLERS

L	T	P	C
3	0	0	3

#### UNIT I      8-BIT MICROPROCESSOR      9

8085 Architecture and memory interfacing – Interfacing I/O devices – Instruction set – Addressing modes – Assembly language programming – Counters and time delays – Interrupts – Timing diagram – Microprocessor applications.

#### UNIT II      MICROCONTROLLER      9

Intel 8031/8051 Architecture – Special Function Registers (SFR) – I/O pins – Ports and circuits – Instruction set – Addressing modes – Assembly language programming – Timer and counter programming – Serial communication – Connection to RS 232 – Interrupts programming – External memory interfacing – Introduction to 16 bit microcontroller.

#### UNIT III      80X86 PROCESSORS      9

8086 Architecture – Pin configuration – 8086 minimum and maximum mode configurations – Addressing modes – Basic instructions – 8086 interrupts – Assembly levels programming – Introduction to 80186, 80286, 80386, 80486 and pentium processors.

#### UNIT IV      PERIPHERALS AND INTERFACING      9

Serial and Parallel I/O (8251 and 8255) – Programmable DMA controller (8257)  
– Programmable interrupt controller (8259) – Keyboard display controller (8279)  
– ADC/DAC interfacing – Inter Integrated Circuits interfacing (I<sup>2</sup>C standard).

#### UNIT V      MICROPROCESSOR BASED SYSTEMS DESIGN, DIGITAL INTERFACING      9

Interfacing to alpha numeric displays – Interfacing to liquid crystal display (LCD 16 X 2 line) – High power devices and optical motor shaft encoders – Stepper motor interfacing – Analog interfacing and industrial control – Microcomputer based smart scale– Industrial process control system – Robotics and embedded control – DSP and digital filters.

**Total: 45**

### **TEXT BOOKS**

1. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications with 8085", 4th Edition, Penram International Publishing 2000.
2. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 Microcontroller and Embedded Systems", Prentice Hall 2000.

### **REFERENCES**

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture Programming and Applications", Penram International Publishing India, 1996.
2. Kenneth J. Ayala, "The 8086 Microprocessor, Programming and Interfacing the PC", Penram International Publishing. 1995.
3. Barry B. Brey, "The Intel Microprocessor 8086/8088, 80186, 80286, 80386 and 80486 Architecture Programming and Interfacing", Prentice Hall of India Pvt.Ltd, 1995.



## EC1311 – DIGITAL SIGNAL PROCESSING

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

### **UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS 10**

Sampling off analog signals – Aliasing – Standard discrete time signals – Classification – Discrete time systems – Linear time invariant – Stable – Casual – Discrete time systems – Classification methods – Linear and circular convolution – Difference equation representation – DFS – DTFT – DFT – FFT computations using DIT and DIF algorithms – Time response and frequency response – Analysis of discrete time systems to standard input signals.

### **UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 9**

Review of design of analogue butterworth and chebyshev filters– Frequency transformation in analogue domain – Design of IIR digital filters using Impulse invariance technique – Design of digital filters using Bilinear transform – Pre-warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

### **UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 9**

Symmetric and anti-symmetric FIR filters – Linear phase FIR filters – Design using frequency sampling technique – Window design using Hamming – Hanning and Blackmann windows – Concept of optimum equi-ripple approximation – Realisation of FIR filters – Transversal – Linear phase and polyphase realization structures.

### **UNIT IV FINITE WORD LENGTH EFFECTS 8**

Quantization noise – Derivation for quantization noise power – Fixed point and binary floating point number representations – Comparison – Overflow error – Truncation error – Coefficient quantization error – Limit cycle oscillations– Signal scaling – Analytical model of sample and hold operations.

### **UNIT V SPECIAL TOPICS IN DSP 9**

Discrete random signals– Mean, variance, co-variance and PSD – Periodiogram computation – Principle of multi rate DSP – Decimation and interpolation by integer factors – Time and frequency domain descriptions – Single, multi stage, polyphase structures – QMF filters – Sub-band coding.

**L: 45 T: 15 Total: 60**

### **TEXT BOOKS**

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing, Algorithms and Applications”, 3rd Edition, Prentice Hall of India Ltd., 2000.
2. Oppenheim, A.V. and Schafer, R.W., “Discrete-time Signal Processing”, Prentice-Hall/ Engle-wood Cliffs, 1991.

### **REFERENCE**

1. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata McGraw–Hill, 1998.
2. Haykin, S., “Adaptive Filter Theory”, Prentice-Hall/ Englewood Cliffs, 1991.
3. Papoulis, A., “Signal Analysis”, McGraw-Hill, 1977.

## **BM1302 – BIO CONTROL SYSTEMS**

**L T P C**  
**3 1 0 4**

### **UNIT I CONTROL SYSTEM MODELLING 9**

System concept – Differential equations – Transfer functions – Modelling of electrical systems – Translational and rotational mechanical systems – Electro-mechanical systems – Physiological systems – Block diagram modelling – Signal flow graphs.

### **UNIT II TIME RESPONSE ANALYSIS 9**

Time domain specifications – Step and impulse response analysis of first order and second order systems – Steady state errors – Stability – Routh-Hurwitz criteria – Root Locus techniques – Construction of Root Locus - Stability – Dominant poles – Applications of Root Locus diagram.

### **UNIT III FREQUENCY RESPONSE ANALYSIS 9**

Frequency response – Bode plot – Nyquist plots – Nyquist stability criterion – Relative stability – Gain margin – Phase margin – Bandwidth magnitude plots – Constant circles – Nichol's chart.

### **UNIT IV PHYSIOLOGICAL CONTROL SYSTEMS 9**

Introduction to physiological control systems – Modelling of human movements – Parameter estimation – Linearizing.

### **UNIT V STUDY OF BIOLOGICAL SYSTEMS 9**

Human thermal system – Neuro muscular system – Respiratory system – Oculomotor system.

**L: 45 T: 15 Total: 60**

### **REFERENCES**

1. Gopal, M., “Control Systems, Principles and Design”, Tata McGraw–Hill, 1997.
2. Benjamin C. Kuo, “Automatic Control Systems”, Prentice Hall of India, 1995.
3. Manfrecllyner and John H. Milsum, “Bio Medical Engineering System”, McGraw–Hill and Co., 1970.

## **BM1303 – BIOMATERIALS AND ARTIFICIAL ORGANS**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **UNIT I        STRUCTURE OF BIOMATERIALS AND BIO-COMPATIBILITY 9**

Definition and classification of biomaterials – Mechanical properties – Visco elasticity – Wound-healing process – Body response to implants – Blood compatibility.

### **UNIT II        IMPLANT MATERIALS 9**

Metallic implant materials – Stainless steels – CO-based alloys – Ti-based alloys – Ceramic implant materials – Aluminum oxides – Hydroxyapatite glass ceramics carbons – Medical applications..

### **UNIT III       POLYMERIC IMPLANT MATERIALS 9**

Polymerisation – Polyolefin – Polyamides – Acrylic – Polymers – Rubbers – High strength thermoplastics – Medical applications.

### **UNIT IV        TISSUE REPLACEMENT IMPLANTS 9**

Soft-tissue replacements – Sutures – Surgical tapes – Adhesive – Percutaneous and skin implants – Maxillofacial augmentation – Blood interfacing implants – Hard tissue replacement implants – Internal fracture fixation devices – Joint replacements.

### **UNIT V        ARTIFICIAL ORGANS 9**

Artificial heart – Prosthetic cardiac valves – Limb prosthesis – Externally powered limb prosthesis – Dental implants.

**Total : 45**

### **TEXT BOOKS**

1. Park, J. B., “Biomaterials Science and Engineering”, Plenum Press, 1984.
2. Sujata V. Bhatt, “Biomaterials”, 2nd Edition ,Narosa Publishing House,2005.

### **REFERENCES**

- Joon B.Park Joseph D. Bronzino ,“Biomaterials - Principles and Applications”, CRC Press, 2003.
- Myer Kutz, “Standard Handbook of Biomedical Engineering & Design”, McGraw-Hill, 2003
- Introduction to Biomedical Engineering – John Enderle, Joseph D. Bronzino, Susan M. Blanchard, Elsevier, 2005.

## BM1304 – BIOINFORMATICS

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

Life in space and time – Dogmas – Data archives – WWW – Computers – Biological classification – Use of sequences – Protein structure – Clinical implications.

### UNIT II GENOME ORGANIZATION 9

Genomics and proteomics – Eavesdropping on transmission of genetic information – Genomes of prokaryotes – Genomes of eukaryotes – Human genome – Snips – Genetic diversity – Evolution of genomes.

### UNIT III ARCHIVES AND INFORMATION RETRIEVAL 9

Introduction – The archives – Gateways to archives.

### UNIT IV ALIGNMENTS AND PHYLOGENETIC TREES 9

Introduction to sequence alignment – The Dotplot – Dotplots and sequence alignments – Measures of sequence similarity – Computing the alignment – The dynamic programming algorithm – Significance of alignments – Multiple sequence alignment – Applications – Phylogeny – Phylogenetic trees.

### UNIT V PROTEIN STRUCTURE AND DRUG DISCOVERY 9

Protein stability and folding – Applications of hydrophobicity – Superposition of structures – Dali – Evolution of protein structures – Classification of protein structures – Protein structure prediction and modeling – Assignment of protein structures to genomes – Prediction of protein function – Drug discovery and development.

**Total : 45**

### TEXT BOOKS

1. Arthur M. Lesk, “Introduction to Bioinformatics”, Oxford University Press, 2004.
2. Lysaght, M., “Biomaterials for Artificial Organs”, CRC Press.

### REFERENCE

1. Attwood, T.K. and Parry–Smith D.J., “Introduction to Bioinformatics”, Pearson Education Asia, 2001.

**EC1312 – MICROPROCESSORS AND MICROCONTROLLERS  
LABORATORY**

**L   T   P   C**  
**0   0   3   2**

**LIST OF EXPERIMENTS**

1. Programming with 8085 – 8 bit / 16 bit Multiplication/Division using Repeated Addition/Subtraction.
2. Programming with 8085 – Code conversion – Decimal arithmetic – Bit manipulations.
3. Programming with 8085, Matrix multiplication, Floating point operations.
4. Programming with 8086 – String manipulation, search, find and replace, copy operations, sorting. (PC required).
5. Using BIOS/DOS calls keyboard control, display, file manipulation. (PC required).
6. Using BIOS/DOS calls disk operations. (PC required).
7. Interfacing with 8085/8086, 8255 and 8253.
8. Interfacing with 8085/8086, 8279 and 8251.
9. 8051 Microcontroller based experiments – Simple assembly language programs. (cross assembler required).
10. 8051 Microcontroller based experiments – simple control applications. (cross assembler required).

**Total: 45**

**BM1305 – BIOMEDICAL INSTRUMENTATION LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

**LIST OF EXPERIMENTS**

1. Study of biological preamplifiers.
2. Recording of ECG signal and analysis.
3. Recording of audiogram.
4. Recording of EMG.
5. Recording of EEG.
6. Recording of various physiological parameters using patient monitoring system and telemetry units.
7. Measurement of pH, pO<sub>2</sub> and conductivity.
8. Study and analysis of functioning and safety aspects of surgical diathermy.
9. Mini project.

**Total: 45**

## BM1306 – DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	3	2

1. Representation of time-series, Computation of convolution.
2. Response of a differential equation with Initial Conditions, Stability.
3. DFT computation.
4. Computational experiments with digital filtering.
5. Sampling and waveform generation.
6. FIR and IIR filters implementation.
7. Fast Fourier transform.
8. Quantization Noise.
9. Adaptive filters.
10. Multirate signal processing.

**Total: 45**

# SEMESTER VI

## CS1357 – DIGITAL IMAGE PROCESSING

L	T	P	C
3	0	0	3

### UNIT I DIGITAL IMAGE FUNDAMENTAL 9

Elements of digital image processing systems – Elements of visual perception – Image sampling and quantization – Matrix and singular value representation of discrete images.

### UNIT II IMAGE TRANSFORMS 9

1-D DFT – 2-D DFT – Cosine – Sine hadamard – Har - Slant KL – SVD transform and their properties.

### UNIT I II IMAGE ENHANCEMENT 9

Histogram – Modification and specification techniques – Image smoothing – Image sharpening – Generation of spatial masks from frequency domain specification – Nonlinear filters – Homomorphic filtering – False color – Pseudocolor and color image processing.

### UNIT IV IMAGE RESTORATION AND RECOGNITION 9

Image degradation models – Unconstrained and constrained restoration – Inverse filtering – Least mean square filter – Pattern classes – Optimal statistical classifiers – Neural networks and associated training methods – Use of neural networks in image processing.

### UNIT V IMAGE COMPRESSION 9

Runlength – Huffman coding – Shift codes – Arithmetic coding – Bit plane coding – Transform coding – JPEG standard – Wavelet transform – Predictive techniques – Block truncation coding schemes – Facet modeling.

**Total : 45**

### TEXT BOOKS

1. Anil K. Jain, “Fundamentals of Digital Image Processing”, Prentice Hall of India, 1997.
2. Rafel C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Addison Wesley, 1993.

### REFERENCES

1. William K. Pratt, “Digital Image Processing”, John Wiley, 1987.
2. Sid Ahmed M.A., “Image Processing Theory, Algorithm and Architectures”, McGraw-Hill, 1995.
3. Scott E.C. Umbaugh, “Computer Vision and Image processing”, Prentice Hall, Eaglewood Cliffs, 1998.





## CS1361 – OBJECT ORIENTED PROGRAMMING AND JAVA

L	T	P	C
3	0	0	3

### UNIT I BASIC CONCEPTS 8

Object – Oriented paradigm – Elements of object oriented programming – Merits and demerits of OO methodology – C++ fundamentals – Data types – Operators and expressions – Control flow – Arrays – Strings – Pointers and functions.

### UNIT II PROGRAMMING IN C++ 10

Classes and objects – Constructors and destructors – Operator overloading – Inheritance – Virtual functions and polymorphism.

### UNIT III FILE HANDLING 9

C++ streams – Console streams – Console stream classes – Formatted and unformatted console I/O operations – Manipulators – File streams – Classes file modes file pointers and manipulations file I/O – Exception handling.

### UNIT IV JAVA FUNDAMENTAL 9

Basics of java – Data types – Variables and arrays – Operators – Control statements – Classes – Objects – Methods – Inheritance.

### UNIT V JAVA PROGRAMMING 9

Packages and interfaces – Exception handling – Multithreaded programming – Strings – Input / Output.

**Total: 45**

### TEXT BOOKS

1. Venugopal, K.R., Rajkumar Buyya and Ravishankar, T., “Mastering C++”, TMH, 2003.
2. Herbert Schildt, “The Java 2 Complete Reference”, 4th Edition, TMH, 2002.

### REFERENCES

1. Ira Pohl, “Object Oriented Programming Using C++”, Pearson Education, 2003.
2. Bjarne Stroustrup, “The C++ Programming Language”, Addison Wesley, 2000.
3. John R. Hubbard, “Programming with C++”, Schaums Outline Series, TMH, 2003.

## CS1362 – DIGITAL IMAGE PROCESSING LABORATORY

L	T	P	C
0	0	3	2

1. To study the image fundamentals.
2. To convert between color models.
3. To learn mathematical transforms necessary for image processing.
4. To perform edge detection algorithm.
5. Types of filters in spatial domain.
6. To study the image enhancement techniques.
7. To study image restoration procedures.
8. To perform text and image compression procedures.

**Total : 45**

## C++

### 1. Programs Using Functions

- Functions with default arguments
- Implementation of call by value , call by address and call by reference

### 2. Simple Classes for understanding objects – member functions and Constructors

- Classes with primitive data members
- Classes with arrays as data members
- Classes with pointers as data members – String class
- Classes with Constant Data Members
- Classes with static member functions

### 3. Compile time Polymorphism

- Operator overloading including unary and binary operators.
- Function overloading

### 4. Runtime Polymorphism

- Inheritance
- Virtual functions
- Virtual Base Classes
- Templates

### 5. File Handling

- Sequential access
- Random access

## JAVA

### 6. Simple Java applications

- for understanding reference to an instance of a class (object) – methods
- Handling strings in Java

### 7. Simple Package creation

- Developing user defined packages in Java

### 8. Interfaces

- Developing user - defined interfaces and implementation
- Use of predefined interfaces

### 9. Threading

- Creation of thread in Java applications
- Multithreading

### 10. Exception Handling Mechanism in Java

- Handling pre-defined exceptions
- Handling user-defined exceptions

## HS1301 – COMMUNICATION AND SOFT SKILLS LABORATORY

L	T	P	C
0	0	3	2

(Common to All Branches of III Year B.E./ B.Tech students of Anna University Tiruchirappalli and affiliated colleges)

The aim of the course is two-fold: to enable the students to develop communication skills in the language laboratory and to arrange discussions for developing soft skills in the lab and/or the classroom. Each lab session shall last for three periods.

### **List of activities that are to be carried out: (15 sessions x 3 periods = 45)**

Lab session # 1: Listening and speaking practice exercises with communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 2: Practice with more advanced communicative functions. Learning material: the ACD of Spoken English: A Foundation Course for Speakers of Indian Languages (Orient Longman, 2008)

Lab session # 3: Pronunciation exercises with Oxford Advanced Learners' Dictionary of Current English or any other standard Dictionary

Lab session # 4: Making an oral presentation in English. Learning Material: Professional Presentations VCD (Cambridge University Press)

Lab session # 5: Listening to telephone conversations in English and completing the tasks. Learning material: Essential Telephoning in English ACD (Cambridge University Press)

Lab session # 6: Giving an exposure to and practice with model group discussion and interviews. Learning material: How to Prepare for Group Discussion and Interview Audio Cassette (McGraw-Hill)

Lab session # 7: Giving insights into the format and the task types in the IELTS (International English Language Testing System). Learning Material: Objective IELTS, Intermediate Level (CUP)

Lab session # 8: Understanding the format and the task types in the TOEFL (Test of English as a Foreign Language). Learning Material: Understanding the TOEFL (Educational Testing Services, Princeton)

Lab session # 9: Administering the BEC (Business English Certificate) Diagnostic Test. Learning Material: BEC Practice Materials (British Council, Chennai)

Lab session # 10: Completing the steps involved in Career, Life Planning and Change Management. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 11: Setting goals and objectives exercises. Learning Material: Developing Soft Skills (Pearson Education)

Lab session # 12: Prioritizing and time planning exercises. Learning Material: Managing Time Multimedia Program CD

Lab session # 13: Taking a Personality Typing/ Psychometric Test Learning Material: 200 Psychometric Test prepared by the CUIC, Anna University Chennai

Lab session # 14: Critical and creative thinking exercises.

Lab session # 15: Improving body language and cross-cultural communication with pictures. Learning material: Body Language (S. Chand and Co.)

For a detailed plan, refer to the topics given below;

## **UNIT I LISTENING AND SPEAKING PRACTICE IN COMMUNICATIVE FUNCTIONS**

Introductions and meetings – Talking about studies and/or job – Expressing likes and dislikes – Describing daily routines and current activities – Talking about past states and events – Talking about future plans and intentions – Expressing preferences – Giving reasons – Expressing opinions, agreement and disagreement – Seeking and giving advice – Making suggestions.

## **UNIT II SPEAKING APPLICATIONS**

Making an oral presentation – Preparing the presentation – Performing the presentation – Beginning – Language – Visual aids and body language – Voice – Ending – Questions – Telephone conversations – Group discussion and interview.

## **UNIT III UNDERSTANDING AND PREPARING FOR INTERNATIONAL ENGLISH LANGUAGE EXAMINATIONS**

International English Language Testing System (IELTS) – Test of English as a Foreign Language (TOEFL) – Business English Certificate (BEC)

## **UNIT IV SOFT SKILLS (1)**

Preparing for and Dealing With Change – Motivation, Goal-Setting and Self-Esteem – Managing Time and Stress – Career and Life Planning – Team Work – Leadership Traits.

## **UNIT V SOFT SKILLS (2)**

Multiple Intelligences – Learning Styles and Personality Typing – Critical and Creative Thinking – People, Cultures and Self – Intercultural Communication.

## **RESOURCES**

1. Kamalesh Sadanand and Susheela Punitha, “Spoken English: A Foundation Course” for Speakers of Indian Languages, Part 2 Audio CD, Hyderabad: Orient Longman, 2008
2. Malcome Goodale, “Professional Presentations”, (VCD) New Delhi: Cambridge University Press, 2005
3. Barbara Garside and Tony Garside, Essential Telephoning in English (Audio CD), Cambridge: Cambridge University Press, 2002
4. Hari Mohan Prasad and Rajnish Mohan, “How to Prepare for Group Discussion and Interview (Audio Cassette)”, Tata McGraw-Hill Publishing
5. International English Language Testing System Practice Tests, CUP
6. Business English Certificate Materials, Cambridge University Press
7. Understanding the TOEFL. Educational Testing Services, Princeton, US
8. Interactive Multimedia Programs on Managing Time and Stress
9. Robert M. Sherfield and et al “Developing Soft Skills”, 4<sup>th</sup> edition, New Delhi, Pearson Education, 2009.

**Total: 45**

## SEMESTER VII

### MG1301 – TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

#### **UNIT I INTRODUCTION 9**

Definition of quality – Dimensions of quality – Quality planning – Quality costs – Analysis techniques for quality costs – Basic concepts of total quality management – Historical review – Principles of TQM – Leadership – Concepts – Role of senior management – Quality council – Quality statements – Strategic planning – Deming philosophy – Barriers to TQM implementation.

#### **UNIT II TQM PRINCIPLES 9**

Customer satisfaction – Customer perception of quality – Customer complaints – Service quality – Customer retention – Employee involvement – Motivation – Empowerment – Teams – Recognition and reward – Performance appraisal – Benefits – Continuous process improvement – Juran trilogy – PDSA cycle – 5S – Kaizen – Supplier partnership – Partnering – Sourcing – Supplier selection – Supplier rating – Relationship development – Performance measures – Basic concepts – Strategy – Performance measure.

#### **UNIT III STATISTICAL PROCESS CONTROL (SPC) 9**

The seven tools of quality – Statistical fundamentals – Measures of central tendency and dispersion – Population and sample – Normal curve – Control charts for variables and attributes – Process capability – Concept of six sigma – New seven management tools.

#### **UNIT IV TQM TOOLS 9**

Benchmarking – Reasons to benchmark – Benchmarking process – Quality Function Deployment (QFD) – House of quality – QFD process – Benefits – Taguchi quality loss function – Total Productive Maintenance (TPM) – Concept – Improvement needs – FMEA – Stages of FMEA.

#### **UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000 and other quality systems – ISO 9000:2000 quality system – Elements – Implementation of quality system – Documentation – Quality auditing, TS 16949 – ISO 14000 – Concept – Requirements and benefits.

**Total : 45**

## **TEXT BOOK**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education, Inc. 2003, Indian reprint 2004. ISBN 81-297-0260-6.

## **REFERENCES**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 5th Edition, South-Western (Thomson Learning), 2002, ISBN 0-324-06680-5.
2. Feigenbaum .A. V., "Total Quality Management", Tata McGraw Hill, 1991.
3. Oakland.J.S., "Total Quality Management" Butterworth – Heinemann Ltd., Oxford , 1989.
4. Narayana V. and Sreenivasan, N. S. "Quality Management – Concepts and Tasks", New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

## CS1404 – PATTERN RECOGNITION AND NEURAL NETWORKS

L	T	P	C
3	0	0	3

### UNIT I      FUNDAMENTALS AND DECISION MAKING      9

Basics – Examples – Statistical decision theory.

### UNIT II      DISCRIMINATION ANALYSIS      9

Linear discriminant analysis – Flexible discriminants.

### UNIT III      NEURAL NETWORKS      9

Feed-forward neural networks – Non-parametric methods – Tree-structured classifiers – Belief networks.

### UNIT IV      UNSUPERVISED ANALYSIS      9

Unsupervised methods finding good pattern features.

### UNIT V      APPLICATIONS      9

Application of pattern recognition in medicine – Application of networks in medicine – Case studies.

**Total : 45**

### TEXT BOOKS

1. Ripley, B.D., “Pattern Recognition and Neural Networks”, Cambridge University Press, 2001
2. Earl Gose, Richard Johnsonbaugh and Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., 1999.

### REFERENCES

1. Jang, J.S.R., Sun, C.T. and Mizutani, E., “Neuro–Fuzzy and Soft Computing”, PHI, 2004.
2. Bishop, C.M., “Pattern Recognition and Machine Learning”, Springer, 2006.

## CS1405 – INTERNET PROGRAMMING

**L T P C**  
**3 1 0 4**

### **UNIT I BASIC INTERNET CONCEPTS 8**

Connecting to the internet – Domain name system – Exchanging e-mail – Sending and receiving files – Fighting spam – Sorting mail and avoiding e-mail viruses – Chatting and conferencing on the internet – Online chatting – Messaging – Usenet newsgroup – Internet Relay Chat (IRC) – Instant messaging – Voice and video conferencing.

### **UNIT II WORLD WIDE WEB 8**

Overview – Web security – Privacy and site blocking – Audio and video on the Web – Creating and maintaining the web – Web site creation – Web page editors – Optimizing web graphics – Web audio files – Forms – Interactivity and database driven web sites – File transfer and downloading – FTP – Peer to peer – Downloading and installing software.

### **UNIT III ADVANCED JAVA PROGRAMMING 12**

Java fundamentals overview – AWT package – Layouts – Containers – Event package – Event model – Painting – Garbage collection – Multithreading – Language packages – Utility packages – Input Output packages – Inner classes – Java database connectivity – Servlets – RMI – Java beans.

### **UNIT IV HTML 9**

HTML – Concepts of tags – Layout – Comments – Paragraphs – Aligning – Line break – Style tags – Address – Links – Formatting – Relative and absolute path – Images – Graphical link to images – CGI – Introduction to java script and perl – Web browsers.

### **UNIT V XML 8**

XML – DHTML – Overview of e-commerce and internet security – JSP – ASP.

**L: 45 P: 15 Total: 60**

### **TEXT BOOKS**

1. Margaret Levine Young, “Internet and WWW”, 2nd Edition, Tata McGraw Hill, 2002.
2. Herbert Schildt, “The Complete Reference, Java 2”, 4th Edition, Tata McGraw Hill, 2001.

### **REFERENCES**

1. Keyur Shah, “Gateway to Java Programmer Sun Certification”, Tata McGraw Hill, 2002.
2. Deitel and Deitel, “Java How to Program”, Prentice Hall, 1999.
3. Comer, D. and Stevans. D., “Internetworking with TCP/IP Vol 1”, 3rd Edition, PHI, 1998.



**BM1403 – DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

1. Study of ultrasonic transducers and displays.
2. Study of pacemaker.
3. Multichannel biotelemetry.
4. Shortwave and ultrasonic diathermy.
5. Multichannel data acquisition system.
6. Simulation of biosignals.
7. Analysis of ECG signals.
8. Analysis of EEG signals.
9. Leakage current and electrical safety measurements.
10. Mini project.

**Total : 45**

## CS1406 – INTERNET PROGRAMMING LABORATORY

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>3</b>	<b>2</b>

1. Programs using utility packages
2. Programs using event orientation handling mechanism.
3. Implement the file operations.
4. Programs using TCP and UDP connections
5. Program using applets.
6. Program using JDBC.
7. Program using JNI concepts.
8. Program to illustrate the use of remote method invocation.
9. Program using servlets.
10. Program using HTML
11. Schematic design using XML
12. Web Page creation using XML

**Total : 45**



**UNIT I OPTICAL PROPERTIES OF THE TISSUES 9**

Refraction – Scattering – Absorption – Light transport inside the tissue – Tissue properties – Light interaction with tissues – Optothermal interaction – Fluorescence – Speckles.

**UNIT II INSTRUMENTATION IN PHOTONICS 9**

Instrumentation for absorption – Scattering and emission measurements – Excitation light sources – High pressure Arc lamp – Solid state LEDs – LASERS – Optical filters – Polarisers – Solid state detectors – Time resolved and phase resolved detectors.

**UNIT III APPLICATIONS OF LASERS 9**

Laser in tissue welding – Lasers in dermatology – Lasers in ophthalmology – Otolaryngology – Urology.

**UNIT IV OPTICAL HOLOGRAPHY 9**

Wavefronts – Interference patterns – Principle of hologram – Optical hologram applications.

**UNIT V SPECIAL TECHNIQUES 9**

Near field imaging of biological structures – In vitro clinical diagnostic – Fluorescent spectroscopy – Photodynamic therapy.

**Total : 45**

**TEXT BOOKS**

1. Tuan Vo Dirh, “Biomedical Photonics – Handbook”, CRC Press, 2003.
2. Leon Goldman, M. D. and Jr. James Rockwell, R., “Lasers in Medicine”, Gordon and Breach, Science Publishers Inc., 1971.

**REFERENCES**

1. Robert Splinter and Brett A. Hooper , “Introduction to Biomedical Optics”, CRC Press, 2006.
2. William R. Hendee, E. Russell Ritenour and E. Russell Ritenour, “ Medical Imaging Physics”, Wiley, John and Sons ,2002

# ELECTIVES ODD SEMESTER

## EC1022 – ANALOG AND DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

### UNIT I MODULATION SYTEMS 9

AM – Single sideband and double sideband modulation – Vestigial sideband modulation – FM phase and frequency modulation – FM spectral analysis – FM bandwidth – AM modulators and FM modulators – AM transmitters and FM transmitters.

### UNIT II RECEIVERS 9

Sensitivity – Selectivity – AM receivers – FM receivers – Noise in AM and FM systems, SNR in AM receivers – Signal to Noise power in FM – Pre-emphasis and De-emphasis.

### UNIT III ANALOG TO DIGITAL CONVERSION 9

Sampling theorem – Pulse Amplitude Modulation (PAM) – Pulse Width Modulation (PWM) – Pulse Position Modulation (PPM) – Pulse Code Modulation (PCM) – Digital modulation and demodulation system – ASK – FSK – PSK.

### UNIT IV INFORMATION THEORY 9

Average information – Information rate – Shannon’s theorem – Channel capacity – Bandwidth – S/N trade off.

### UNIT V SATELLITE ACCESS 9

Modulation and multiplexing voice – Data – Video – Analog-Digital transmission system – Digital video broadcast – Multiple access – FDMA – TDMA – CDMA – Assignment methods – Spread spectrum communication – Compression – Encryption.

**Total: 45**

### TEXT BOOK

Wayne Tomasi, “Electronic Communication Systems, Fundamentals Through Advanced”, 4th Reprint, LPE, Pearson Education, 2001.

### REFERENCE

1. Taub and Schilling, “Principles of Communication Systems”, McGraw-Hill, 1986.

## GE1001 – INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
3	0	0	3

### UNIT I

5

Introduction – Invention and creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property – Movable property – Immovable property and – Intellectual property.

### UNIT II

10

IP – Patents – Copyrights and related rights – Trade marks and rights arising from trademark registration – Definitions – Industrial designs and integrated circuits – Protection of geographical indications at national and international levels – Application procedures.

### UNIT III

10

International convention relating to intellectual property – Establishment of WIPO – Mission and activities – History – General Agreement on Trade and Tariff (GATT).

### UNIT IV

10

Indian position Vs WTO and strategies – Indian IPR legislations – Commitments to WTO – Patent ordinance and the bill – Draft of a national intellectual property policy – Present against unfair competition.

### UNIT V

10

Case studies on – Patents (Basumati rice, Turmeric, Neem, etc.) – Copyright and related rights – Trade marks – Industrial design and integrated circuits – Geographic indications – Protection against unfair competition.

**Total: 45**

### TEXT BOOK

1. Subbaram, N.R., “Handbook of Indian Patent Law and Practice”, S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

### REFERENCES

1. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000, [www.ipmatters.net/features/000707\\_gibbs.html](http://www.ipmatters.net/features/000707_gibbs.html).

## GE1002 – INDIAN CONSTITUTION AND SOCIETY

L	T	P	C
3	0	0	3

### UNIT I 9

Historical background – Constituent assembly of India – Philosophical foundations of the Indian constitution – Preamble – Fundamental rights – Directive principles of state policy – Fundamental duties – Citizenship – Constitutional remedies for citizens.

### UNIT II 9

Union government – Structures of the union government and functions – President – Vice president – Prime minister – Cabinet – Parliament – Supreme court of India – Judicial review.

### UNIT III 9

State government – Structure and functions – Governor – Chief minister – Cabinet – State legislature – Judicial system in states – High courts and other subordinate courts.

### UNIT IV 9

Indian federal system – Center – State relations – President's rule – Constitutional amendments – Constitutional functionaries – Assessment of working of the parliamentary system in India.

### UNIT V 9

Society – Nature, meaning and definition – Indian social structure – Caste – Religion, language in India – Constitutional remedies for citizens – Political parties and pressure groups – Rights of women – Children and scheduled castes and scheduled tribes and other weaker sections.

**Total: 45**

### TEXT BOOKS

1. Durga Das Basu, "Introduction to the Constitution of India", 19th Edition, Prentice Hall of India, 2008.
2. Agarwal, R.C., "Indian Political System", S.Chand and Company, 1997.
3. *Maciver and Page*, "Society: An Introduction Analysis", Mac Milan India Ltd.
4. Sharma K.L., "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, 1997.

### REFERENCES

1. Sharma and Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, 2007.
2. Gahai, U.R., "Indian Political System", New Academic Publishing House, 1998.
3. Sharma, R.N., "Indian Social Problems", Media Promoters and Publishers Pvt. Ltd, 1999.
4. Yogendra Singh, "Social Stratification and Change in India", Manohar, 1977.

## CS1020 – SOFT COMPUTING

**L T P C**  
**3 0 0 3**

### **UNIT I FUZZY SET THEORY 10**

Introduction to neuro, fuzzy and soft computing – Fuzzy sets – Basic definition and terminology – Set-theoretic operations – Member function formulation and parameterization – Fuzzy rules and fuzzy reasoning – Extension principle and fuzzy relations – Fuzzy If-Then rules – Fuzzy reasoning – Fuzzy inference systems – Mamdani fuzzy models – Sugeno fuzzy models – Tsukamoto fuzzy models – Input space partitioning and fuzzy modeling.

### **UNIT II OPTIMIZATION 8**

Derivative-based optimization – Descent methods – The method of steepest descent – Classical newton’s method – Step size determination – Derivative-free optimization – Genetic algorithms – Simulated annealing – Random search – Downhill simplex search.

### **UNIT III NEURAL NETWORKS 10**

Supervised learning neural networks – Perceptrons – Adaline – Backpropagation multilayer perceptrons – Radial basis function networks – Unsupervised learning neural networks – Competitive learning networks – Kohonen self-organizing networks – Learning vector quantization – Hebbian learning.

### **UNIT IV NEURO FUZZY MODELING 9**

Adaptive neuro-fuzzy inference systems – Architecture – Hybrid learning algorithm – Learning methods that cross-fertilize ANFIS and RBFN – Coactive neuro fuzzy modeling – Framework neuron functions for adaptive networks – Neuro fuzzy spectrum.

### **UNIT V APPLICATIONS OF COMPUTATIONAL INTELLIGENCE 8**

Printed character recognition – Inverse kinematics problems – Automobile fuel efficiency prediction – Soft computing for color recipe prediction.

**Total: 45**

#### **TEXT BOOKS**

1. Jang J S.R., Sun, C.T and Mizutani E., “Neuro–Fuzzy and Soft Computing”, PHI, Pearson Education 2004.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw–Hill, 1997.

#### **REFERENCES**

1. Davis E. Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, 1989.
2. Rajasekaran, S. and Pai, G.A.V., “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Eberhart, R., Simpson, P. and Dobbins R., “Computational Intelligence – PC Tools”, AP Professional, 1996.

## BM1001 – PHYSIOLOGICAL MODELLING

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTION 9

System concept – System properties – Piece-wise linear approximation – Electrical analog for compliance – Thermal storage – Pulse response of first order systems – Response of resistant and compliance system.

### UNIT II TRANSFER FUNCTIONS 9

Transfer functions and its use – Engineering concept in coupled system – Example of transformed signals.

### UNIT III IMPEDANCE CONCEPT 9

Circuits for the transfer function with impedance concept – Prediction of performance – Periodic signals.

### UNIT IV FEEDBACK SYSTEMS 9

Characteristics of physiological feedback systems – Uses and testing of system stability.

### UNIT V SIMULATION OF BIOLOGICAL SYSTEMS 9

Simulation of thermal regulation – Pressure and flow control in circulation – Occulo motor system – Endocrinal system – Functioning of receptors.

**Total: 45**

### TEXT BOOKS

1. William B. Blesser, “A System Approach to Bio–medicine”, McGraw–Hill book co., 1969.
2. Michael C. K. Khoo , “Physiological Control Systems: Analysis, Simulation, and Estimation (IEEE Press Series on Biomedical Engineering)”, Wiley-IEEE Press ,1999.

### REFERENCES

1. Manfredo Clynes and John H. Milsum, “Bio–medical Engineering System”, McGraw–Hill Book co., 1970.
2. Douglas S. Regs, “Control Theory and Physiological Feedback Mechanism”, The William and Williams co., 1970.



## **BM1003 – REFRIGERATION AND AIR CONDITIONING**

**L T P C**  
**3 0 0 3**

### **UNIT I REFRIGERATION CYCLES AND REFRIGERANTS 9**

Vapour compression refrigeration cycle – Simple saturated vapour compression refrigeration cycle – Thermodynamic analysis – Refrigerant classification – Designation – Alternate refrigerants – Global warming, potential and ozone depleting potential aspects.

### **UNIT II SYSTEM COMPONENTS 9**

Refrigerant compressors – Reciprocating open and hermetic type – Screw compressors and scroll compressors – Construction and operation characteristics – Evaporators – DX coil – Flooded type chillers expansion devices – Automatic expansion valves – Capillary tube and thermostatic expansion valves – Condensing units and cooling towers.

### **UNIT III CYCLING CONTROLS AND SYSTEM BALANCING 9**

Pressure and temperature controls – Range and differential settings – Selection and balancing of system components – Graphical method.

### **UNIT IV PSYCHROMETRY 9**

Moist air behaviour – Psychrometric chart – Different psychrometric process analysis.

### **UNIT V AIR CONDITIONING 9**

Summer and winter air-conditioning – Cooling load calculations – Air distribution patterns – Dynamic and frictional losses in air ducts – Equal friction method – Fan characteristics in duct systems.

**Total: 45**

#### **TEXT BOOKS**

1. Stocker W.F and Jones J.W., “Refrigeration and Air Conditioning” McGraw Hill Book Company, 1985.
2. Althouse A.D., Turnquist C.H. and Bracianno A.F., “Modern Refrigeration and Air Conditioning - Study Guide”, 18th Edition, Goodheart-Willcox Co Inc. 2003.

#### **REFERENCES**

1. Dossat R.J., “Principles of Refrigeration”, John Wiley and Sons Inc., 1989.
2. Manohar Prasad, “Refrigeration and Air Conditioning”, Wiley Eastern Ltd., 1995.

# ELECTIVES EVEN SEMESTER

## BM1004 – BIO FLUIDS AND DYNAMICS

L	T	P	C
3	0	0	3

### UNIT I INTRODUCTORY CONCEPTS 9

Fluids and non-fluids – Continuum coordinate systems – Force and moments – Stress at a point – Rate of strain – Properties of fluids – Classification of fluids.

### UNIT II FLUID FLOW 9

Different types of fluid flows – Laminar and turbulent flow – Transition from laminar to turbulent flow – Laminar flow – Annulus – Laminar flow between parallel plates – Measurement of viscosity.

### UNIT III BOUNDARY LAYER FLOW 9

Development of boundary layer – Estimates of boundary layer thickness – Boundary layer equation – Nature of turbulence – Smooth and rough surface – Boundary layer separation.

### UNIT IV PRESSURE AND FLOW IN BLOOD VESSELS 9

Friction loss in flow in a tube – Velocity distribution of Aortic system – Waveform of pressure and velocity in Aorta – Wave reflections and impedance in Arterial segments – Blood flow in Veins and blood flow in capillaries.

### UNIT V ANALYSIS OF CARDIO VASCULAR DYNAMICS 9

Control theory and system analysis – Mechanical analysis of circulatory systems – Basic concept of myocardial mechanics – Index of contractibility – Fluid dynamics of Aortic and Mitral valves.

**Total: 45**

### TEXT BOOK

1. Kumar K. L., “Engineering Fluid Mechanics”, Eurasia Publishing House Pvt.Ltd., 1998.
2. Bergel D. H., “Cardiovascular Fluid Dynamics” Vol. I, Academic press, London and New York, 1972.

### REFERENCES

1. Clayton T. Crowe, Donald F. Elger, and John A. Roberson, “Engineering Fluid Mechanics”, 7th Edition, John Wiley & Sons 2000
2. Michael J. Moran, “Fundamentals of Engineering Thermodynamics: AND Brief Fluid Mechanics”, 6th Revised Edition, John Wiley & Sons,2008.

## BM1005 – TELE-HEALTH TECHNOLOGY

**L T P**  
**3 0 0**

### **UNIT I CONCEPTS 9**

Tele-medicine – Tele-healthcare and E-medicine – Use of computers in distance mode of healthcare delivery.

### **UNIT II COMMUNICATION SYSTEMS AND NETWORKS IN TELE-HEALTH TECHNOLOGY 9**

Web technology – Satellite communication systems – Hypertext, voice and image transfer protocols – Medical image scanning – Data compression and transfer – Capturing of medical signals – Analog to digital conversion – Video conferencing – Remote sensing – Rural primary setups – Referral and super specialty centers – Societal medico legal aspects – Networking (Local, National and Global) – Information security and confidentiality modelling and functions of PACS and HIS.

### **UNIT III APPLICATIONS 9**

Introduction – Archives – CABRI (Common Access to Biological Resources and Information) – Database indexing and search terms – Nucleic and genome databases – Molecular data base and servers – Array express – Gateway to archives- Sequential retrieval system- Protein Identification Resource(PIR)

### **UNIT IV ADVANCED APPLICATIONS 9**

Telecardiology – Teledermatology – Teleneurology – Teleophthalmology – Telepathology – Telepediatrics – Telepharmacy – Telepsychiatry and mental health – Teleradiology – Telesurgery – Veterinary – Other specialties

### **UNIT V CASE STUDIES 9**

Tele- health technology and Health care delivery for rural population – use of tele -health technology for clinical diagnostic study – conceptual frame work on home tele- health care.

**Total: 45**

### **TEXT BOOK**

1. Marilyn J. Field, “A Guide to Assessing Telecommunications in Health Care”, NATIONAL ACADEMY PRESS, 1996.
2. Bashshur , R. L. , Sanders, J. H and Shannon, G. W., “Telemedicine: Theory and Practice”, Volume 27, Number 2, Springer Netherlands, 1999,

### **REFERENCES**

1. <http://tie.telemed.org/links/specialties.asp>
2. Refer Telemedicine Journal and E-Health for further reference



## EC1023 – VLSI DESIGN

**L T P C**  
**3 0 0 3**

### **UNIT I MOS TECHNOLOGY AND CIRCUITS 9**

MOS technology and VLSI – Process parameters and considerations for BJT, MOS and CMOS – Electrical properties of MOS circuits and device modelling.

### **UNIT II MOS CIRCUIT DESIGN PROCESS 9**

MOS layers – Stick diagram – Layout diagram – Propagation delays – Examples of combinational logic design – Scaling MOS circuits.

### **UNIT III DIGITAL CIRCUITS AND SYSTEMS 9**

Programmable Logic Array (PLA) and finite state machines – Design of ALU's memories and registers.

### **UNIT IV ANALOG VLSI AND HIGH SPEED VLSI 9**

Introduction to analog VLSI – Models for analog switches – Active resistors – Current sources / sinks – Current references – BJT and CMOS operational amplifiers for simulation – Layout of typical circuits like common source amplifier – Current source and differential amplifier – Sub-micron technology and GaAs VLSI technology.

### **UNIT V HARDWARE DESCRIPTION LANGUAGES 9**

VHDL background and basic concepts – Structural specification of hardware and design organisation and parameterization.

**Total: 45**

### **TEXT BOOKS**

1. Douglas A. Pucknell and Kamran Eshrafhian, "Basic VLSI Design Systems and Circuits", Prentice Hall of India Pvt., Ltd.
2. Randall L. Geiger and Allen P. E., "VLSI Design Techniques for Analog and Digital Circuits", McGraw-Hill Int., Co., 1990.
3. Peter J. Ashenden, "The Designer's guide to VHDL", Harcourt Asia Pvt., Ltd., 1995.

### **REFERENCES**

1. Amar Murkherjee, "Introduction to NMOS and CMOS VLSI System Design", Prentice Hall, 1986.
2. Fabious, E., "Introduction to VLSI design", McGraw-Hill, 1990.
3. Navabi, Z., "VHDL Analysis and Modeling of Digital Systems", McGraw-Hill, 1983.
4. Mohammed Ismail and Terri Fiez, "Analog VLSI, Signal and Information Processing", McGraw-Hill, 1994.
5. Neil, H.E. Weste, Kamaran Eshraghian, "Principles of CMOS VLSI Design", Addison Wesley, 1998.

## CS1035 – COMPUTER NETWORKS

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### **UNIT I DATA COMMUNICATION CONCEPTS 8**

ISO – OSI layered architecture – Transmission media – Data encoding – Interface and modems – Multiplexing – Error detection and correction – Digital subscriber line – Circuit switching – Packet switching – Message switching.

### **UNIT II WIDE AREA NETWORKS 10**

Data link protocols – HDLC– LAPB – LAPD – Inter networking devices – Repeaters – Bridges – Routers – Routing algorithms – Distance vector routing – Link state routing – X.25 protocol – Congestion control.

### **UNIT III LOCAL AREA NETWORK 10**

LAN topology – Ethernet – Token bus – Token ring – FDDI – Wireless LAN – LAN – IEEE 802 Medium access control layer standard – Random access protocols – ALOHA – Slotted ALOHA.

### **UNIT IV FRAME RELAY AND ATM NETWORKS 9**

Frame relay operation – Layers and traffic control – ATM networks – Architecture switching – Layers service classes.

### **UNIT V UPPER OSI LAYERS 8**

Transport layer issues – Session layer – Synchronization – Presentation layer – Encryption – Decryption – Application layer – Message handling system – File transfer – Virtual terminal – E-mail.

**Total : 45**

### **TEXT BOOKS**

1. William Stallings, “Data and Computer Communication”, 6th Edition, Pearson education Asia, 2000.
2. Behrouz A. Forouzan, “Data Communication and Networking”, 2nd Edition, Tata McGraw–Hill, 2000.

### **REFERENCES**

1. Fred Halsall, “Data Communication, Computer Networks and Open Systems”, 4th Edition, Addison Wesley, 1995.
2. Andrew S. Tanenbaum, “Computer Networks”, 3rd Edition, PHI, 1996.

## **BM1007 – RAPID PROTOTYPING**

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### **UNIT I INTRODUCTION 7**

Need for time compression in product development – Product development – Conceptual design – Development – Detail design – Prototype – Tooling.

### **UNIT II CLASSIFICATION OF RP SYSTEMS 9**

Stereo lithography systems – Principle – Process parameters – Process details – Machine details – Applications – Direct Metal Laser Sintering (DMLS) system – Principle – Process parameters – Process details – Machine details – Applications.

### **UNIT III MODELING 9**

Fusion deposition modeling – Principle – Process parameters – Process details – Machine details, applications – Laminated object manufacturing – Principle – Process parameters – Process details – Machine details – Applications.

### **UNIT IV SOLID GROUND CURING 10**

Principle – Process parameters – Process details – Machine details and applications – 3- dimensional printers – Principle – Process parameters – Process details – Machine details, applications – Other concept modelers like thermo jet printers – Sander’s model maker – JP system 5 – Object quadra system.

### **UNIT V RAPID TOOLING 10**

Laser Engineering Net Shaping (LENS) – Ballistic Particle Manufacturing (BPM) – Principle – Introduction to rapid tooling – Direct and indirect method – Software for RP – STL files – Magics – Mimics – Application of rapid prototyping in medical field.

**Total: 45**

### **TEXT BOOKS**

1. Pham D.T and Dimov S.S., “Rapid Manufacturing”, Springer–Verlag, 2001.
2. Neil Hopkinson, Richard Hague and Philip Dickens , “Rapid Manufacturing: An Industrial Revolution for the Digital Age”, Wiley,2006.

### **REFERENCE**

1. Terry Wohlers, “Wohlers Report 2000”, Wohlers Associates, 2000.

## GE1301 – PROFESSIONAL ETHICS AND HUMAN VALUES

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### UNIT I HUMAN VALUES 10

Morals, values and ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Co-operation – Commitment – Empathy – Self-confidence – Character – Spirituality .

### UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issued – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles – Theories about right action – Self-interest – Customs and religion – Uses of ethical theories.

### UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – a balanced outlook on law – the challenger case study.

### UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk – the Three mile island and chernobyl case studies – Collegiality and loyalty – Respect for authority – Collective bargaining – Confidentiality – Conflicts of interest – Occupational crime – Professional rights – Employee rights – Intellectual Property Rights (IPR) – Discrimination.

### UNIT V GLOBAL ISSUES 8

Multinational corporations – Environmental ethics – Computer ethics – Weapons development – Engineers as managers–consulting engineers–engineers as expert witnesses and advisors – Moral leadership–Sample code of ethics like ASME, ASCE – IEEE – Institution of engineers (India), Indian institute of materials management – Institution of Electronics and Telecommunication Engineers (IETE) – India, etc.

**Total: 45**

### TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw–Hill, 1996.
2. Govindarajan M., Natarajan, S. and Senthil Kumar V.S., "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

### REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education/ Prentice Hall, 2004 (Indian Reprint)
2. Charles E. Harris, Michael S. Protchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, 2000.
3. John R. Boatright, " Ethics and the Conduct of Business", Pearson Education, 2003.
4. Edmund G. Seebauer and Robert L. Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.

**UNIT I FUNDAMENTALS AND TECHNOLOGY 9**

Dielectrics – Ferroelectrics – Electronic properties and quantum effects – Magneto-electronics – Magnetism and magnetotransport in layered structures – Organic molecules – Electronic structures – Properties, and reactions – Neurons – The molecular basis of their electrical excitability – Circuit and system design– Film deposition methods – Lithography – Material removing techniques – Etching and chemical mechanical polishing – Analysis by diffraction and fluorescence methods – Scanning probe techniques.

**UNIT II LOGIC DEVICES 9**

Silicon MOSFETs – Novel materials and alternative concepts – Ferroelectric field effect transistors – Quantum transport devices based on resonant tunneling – Single-electron devices for logic applications – Superconductor digital electronics – Quantum computing using superconductors – Carbon nanotubes for data processing – Molecular electronics.

**UNIT III RANDOM ACCESS MEMORIES AND MASS STORAGE DEVICES 9**

High-permittivity materials for DRAMs – Ferroelectric random access memories – magnetoresistive RAM – Hard disk drives – Magneto-optical discs – Rewriteable DVDs based on phase change materials – Holographic data storage – AFM-based mass storage – The millipede concept.

**UNIT IV DATA TRANSMISSION AND INTERFACES 9**

Transmission on chip and board level – Photonic networks – Microwave Communication systems – Novel approaches for passive devices – Neuro electronic interfacing – Semiconductor chips with ion channels – Nerve cells and brain.

**UNIT V SENSOR ARRAYS, IMAGING SYSTEMS AND DISPLAYS 9**

Optical 3-D time-of-flight imaging system – Pyroelectric detector arrays for IR imaging – Electronic noses – 2-D tactile sensors and tactile sensor arrays – Liquid crystal displays – Organic light emitting devices – Field-emission and plasma displays.

**Total: 45**

## **TEXTBOOKS**

1. Rainer Waser, “Nanoelectronics and Information Technology (Advanced Electronic Materials and Novel Devices)”, Wiley–VCH, 2003.
2. Ando, T., Arakawa, Y., Furuya, K., Komiuyama, S. and Nakashima H., “Mesophysics and Electronics”, Springer, 1998.

## **REFERENCES**

1. Jr. Poole C.P. and Owens, F.J., “ Introduction to Nanotechnology”, Wiley, 2003.
2. Drexler K. E., “Nanosystems”, Wiley,1992.
3. Petty, M.C, Bryce, M.R and Bloor, D., “Introduction to Molecular Electronics”, Edward Arnold, 1995.
4. Awschalom, D.D., Loss, D. and Samarth N., “Semiconductor Spintronics and Quantum Computation”, Springer, 2002.
5. Mitin, V., Kochelap, V. and Stroschio M., “Quantum Heterostructures” Cambridge, 1999.
6. Scherge, M. and Gorb, S., “Micro-Biological and Nano-Tribology”, Springer, 2001.
7. Ferry, D.K, and Grondin, R.O., “Physics of Submicron Devices”, Plenum Press,1991.
8. Nielsen, M.A and Chung, I.L., “Quantum Computation and Quantum Information”, Cambrige, 2000.
9. Calude, C.S. and Paun, F., “Computing with Cells and Atoms”, Tayor and Francis, 2001.
10. Sze, S.M., “VLSI Technology”, McGraw–Hill,1998.
11. Sung-Mo Kang and Yusuf Leblebici, “CMOS: Digital Integrated Circuits”, McGraw–Hill, 1999.

## CS1036 – DATA STRUCTURES

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### UNIT I PROBLEM SOLVING 9

Problem solving – Top-down design – Implementation – Verification – Efficiency – Analysis – Sample algorithms.

### UNIT II LISTS – STACKS AND QUEUES 8

Abstract Data Type (ADT) – The list ADT – The stack ADT – The queue ADT.

### UNIT III TREES 10

Preliminaries – Binary trees – The search tree ADT – Binary search trees – AVL trees – Tree traversals – Hashing – General idea – Hash function – Separate chaining – Open addressing – Linear probing – Priority queues (Heaps) – Model – Simple implementations – Binary heap.

### UNIT IV SORTING 9

Preliminaries – Insertion sort – Shell sort – Heap sort – Merge sort – Quick sort – External sorting.

### UNIT V GRAPHS 9

Definitions – Topological sort – Shortest path algorithms – Unweighted shortest paths – Dijkstra’s algorithm – Minimum spanning tree – Prim’s algorithm – Applications of depth first search – Undirected graphs – Biconnectivity – Introduction to NP completeness.

**Total: 45**

### TEXT BOOKS

1. Dromey, R.G., “How to Solve it by Computer” Prentice–Hall of India, 2002.
2. Weiss M.A., “Data Structures and Algorithm Analysis in C”, 2nd Edition, Pearson Education, 2002.

### REFERENCES

1. Langsam, Y., Augenstein, M.J. and Tenenbaum, A.M., “Data Structures using C”, Pearson Education, 2004.
2. Richard F. Gilberg and Behrouz A. Forouzan, “Data Structures-A Pseudocode Approach with C”, Thomson Brooks / COLE, 1998.