ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R-2008

B.E. BIOMEDICAL ENGINEERING

II- VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER II

SL. No.	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	HS2161	Technical English – II*	3	1	0	4
2.	MA2161	Mathematics – II*	3	1	0	4
3.	PH2161	Engineering Physics – II*	3	0	0	3
4.	CY2161	Engineering Chemistry – II*	3	0	0	3
5. a	ME2151	Engineering Mechanics **(For non-circuit branches)**	3	1	0	4
5. b	EE2151	Circuit Theory **(For branches under Electrical Faculty)**	3	1	0	4
5. c	EC2151	Electric Circuits and Electron Devices **(For branches under I & C Faculty)**	3	1	0	4
6. a	GE2151	Basic Electrical & Electronics Engineering **(For non-circuit branches)**	4	0	0	4
6. b	GE2152	Basic Civil & Mechanical Engineering **(For circuit branches)**	4	0	0	4
PRACTICALS						
7.	GE2155	Computer Practice Laboratory-II*	0	1	2	2
8.	GS2165	Physics & Chemistry Laboratory - II*	0	0	3	2

9. a	ME2155	Computer Aided Drafting and Modeling Laboratory **(For non-circuits branches)**	0	1	2	2
9. b	EE2155	Electrical Circuits Laboratory **(For branches under Electrical Faculty)**	0	0	3	2
9. c	EC2155	Circuits and Devices Laboratory **(For branches under I & C Faculty)**	0	0	3	2
					TOTAL : 28 CREDITS	
10.	-	English Language Laboratory +	0	0	2	-

*** Common to all B.E. / B.Tech. Programmes**

+ Offering English Language Laboratory as an additional subject (with no marks) during 2nd semester may be decided by the respective Colleges affiliated to Anna University Chennai.

A. CIRCUIT BRANCHES

I Faculty of Electrical Engineering

1. B.E. Electrical and Electronics Engineering
2. B.E. Electronics and Instrumentation Engineering
3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering

1. B.E. Computer Science and Engineering
2. B.E. Electronics and Communication Engineering
3. B.E. Bio Medical Engineering
4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I Faculty of Civil Engineering

1. B.E. Civil Engineering

II Faculty of Mechanical Engineering

1. B.E. Aeronautical Engineering
2. B.E. Automobile Engineering
3. B.E. Marine Engineering
4. B.E. Mechanical Engineering
5. B.E. Production Engineering

III Faculty of Technology

1. B.Tech. Chemical Engineering
2. B.Tech. Biotechnology
3. B.Tech. Polymer Technology
4. B.Tech. Textile Technology
5. B.Tech. Textile Technology (Fashion Technology)
6. B.Tech. Petroleum Engineering
7. B.Tech. Plastics Technology

SEMESTER III

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
MA 2211	Transforms and Partial Differential Equations	3	1	0	4
BM 2201	Medical Physics	3	0	0	3
BM 2202	Signals and Systems	3	1	0	4
BM 2203	Sensors and Measurements	3	1	0	4
BM 2204	Electronic Circuits	3	1	0	4
BM 2205	Biochemistry	3	0	0	3
BM 2206	Anatomy and Human Physiology	3	0	0	3
PRACTICAL					
BM 2208	Biochemistry and Human Physiology Lab	0	0	4	2
BM 2209	Electronic Circuits Lab	0	0	3	2
	TOTAL	**21**	**4**	**7**	**29**

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
MA 2261	Probability and Random Processes	3	1	0	4
BM 2251	Biomedical Instrumentation	3	0	0	3
BM 2253	Basics of Electrical Engineering	3	0	0	3
BM 2254	Analog and Digital ICs	3	1	0	4
BM 2252	Pathology and Microbiology	3	0	0	3
BM 2255	Analog and Digital Communication	3	0	0	3
GE 2021	Environmental Science and Engineering	3	0	0	3
PRACTICAL					
BM 2257	Integrated Circuits Lab	0	0	3	2
BM 2258	Pathology and Microbiology Lab	0	0	4	2
	TOTAL	**21**	**2**	**7**	**27**

SEMESTER V

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
BM2305	Digital Signal Processing	3	1	0	4
BM2301	Bio control systems	3	1	0	4
BM2302	Diagnostic and Therapeutic Equipment I	3	0	0	3
BM2303	Bio materials and artificial organs	3	0	0	3
EC2363	Microprocessor, Microcontroller and System Design	3	0	0	3
BM2304	Hospital Management	3	0	0	3
PRACTICAL					
BM2306	Microprocessor and Microcontroller Lab	0	0	3	2
BM2307	Biomedical Instrumentation Lab	0	0	3	2
GE2321	Communication Skills Lab	0	0	4	2
	TOTAL	**18**	**2**	**10**	**26**

SEMESTER VI

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
BM2351	Radiological Equipment	3	0	0	3
BM2352	Biomechanics	3	0	0	3
BM2353	Diagnostic and Therapeutic Equipments II	3	0	0	3
CS2361	Internet and Java	3	0	0	3
	Elective I	3	0	0	3
	Elective II	3	0	0	3
PRACTICAL					
BM2356	Digital Signal Processing Lab	0	0	3	2
CS2362	Internet and Java programming Lab	0	0	3	2
BM2355	Diagnostic and Therapeutic Equipment Lab	0	0	3	2
	TOTAL	**18**	**0**	**9**	**24**

SEMESTER VII

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
BM2401	Pattern Recognition and Neural Networks	3	0	0	3
BM2402	Medical Informatics	3	0	0	3
BM2403	Medical Optics	3	0	0	3
BM2404	Digital Image Processing	3	0	0	3
	Elective III	3	0	0	3
	Elective IV	3	0	0	3
PRACTICAL					
BM2405	Hospital Training	0	0	4	2
BM2406	Digital Image Processing Lab	0	0	3	2
	TOTAL	**18**	**0**	**7**	**22**

SEMESTER VIII

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	L	T	P	C
THEORY					
	Elective V	3	0	0	3
	Elective VI	3	0	0	3
PRACTICAL					
BM2451	Project Work	0	0	12	6
	TOTAL	**6**	**0**	**12**	**12**

LIST OF ELECTIVES

SEMESTER VI – Elective I

Code No.	Course Title	L	T	P	C
BM2021	BioFluids and Dynamics	3	0	0	3
BM2022	Biometric Systems	3	0	0	3
EC2303	Computer Architecture and Organization	3	0	0	3

SEMESTER VI – Elective II

Code No.	Course Title	L	T	P	C
CS2068	Data Structures and Object Oriented Programming	3	0	0	3
GE2071	Intellectual Property Rights	3	0	0	3
GE2072	Indian Constitution and Society	3	0	0	3

SEMESTER VII - Elective III

Code No.	Course Title	L	T	P	C
BM2023	Physiological Modelling	3	0	0	3
BM2024	BioInformatics	3	0	0	3
GE2022	Total Quality Management	3	0	0	3
EC2038	Nano Electronics	3	0	0	3

SEMESTER VII - Elective IV

Code No.	Course Title	L	T	P	C
EC2352	Computer Networks	3	0	0	3
CS2069	Computer Hardware, Interfacing and Instrumentation	3	0	0	3
BM2027	Refrigeration and Air Conditioning	3	0	0	3

SEMESTER VIII - Elective V

Code No.	Course Title	L	T	P	C
BM2029	BioMEMS	3	0	0	3
BM2025	Assist Devices	3	0	0	3
EC2354	VLSI Design	3	0	0	3
GE2025	Professional Ethics in Engineering	3	0	0	3

SEMESTER VIII - Elective VI

Code No.	Course Title	L	T	P	C
BM2026	Medical Imaging Techniques	3	0	0	3
CS2053	Soft Computing	3	0	0	3
BM2028	Rapid Prototyping	3	0	0	3

HS2161 **TECHNICAL ENGLISH II** **L T P C**
3 1 0 4

AIM:
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES:
1. To help students develop listening skills for academic and professional purposes.
2. To help students acquire the ability to speak effectively in English in real-life situations.
3. To inculcate reading habit and to develop effective reading skills.
4. To help students improve their active and passive vocabulary.
5. To familiarize students with different rhetorical functions of scientific English.
6. To enable students write letters and reports effectively in formal and business situations.

UNIT I **12**
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading& predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix 'self' - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II **12**
Phrases / Structures indicating use / purpose – Adverbs-Skimming – Non-verbal communication - Listening – correlating verbal and non-verbal communication -Speaking in group discussions – Formal Letter writing – Writing analytical paragraphs.

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits– Writing analytical paragraphs on different debatable issues.

UNIT III **12**
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations .

Suggested activities:

1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object –verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.
4. Sequencing of jumbled sentences using connectives – Writing different types of reports like industrial accident report and survey report – Writing recommendations.

UNIT IV **12**

Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:

1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.
5. Writing descriptions, expanding hints – Writing argumentative paragraphs – Writing formal letters – Writing letter of application with CV/Bio-data – Writing general and safety instructions – Preparing checklists – Writing e-mail messages.

UNIT V **9**

Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:

1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Chapters 5 – 8. Department of Humanities & Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 & 2), Chennai: Orient Longman Pvt. Ltd., 2006. Themes 5 – 8 (Technology, Communication, Environment, Industry)

REFERENCES:

1. P. K. Dutt, G. Rajeevan and C.L.N Prakash, 'A Course in Communication Skills', Cambridge University Press, India 2007.
2. Krishna Mohan and Meera Banerjee, 'Developing Communication Skills', Macmillan India Ltd., (Reprinted 1994 – 2007).
3. Edgar Thorpe, Showick Thorpe, 'Objective English', Second Edition, Pearson Education, 2007.

Extensive Reading:

1. Robin Sharma**, '**The Monk Who Sold His Ferrari', Jaico Publishing House, 2007

Note:

The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

MA2161 MATHEMATICS – II L T P C
3 1 0 4

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelpipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of residue theorem to evaluate real integrals – Unit circle and semi-circular contour(excluding poles on boundaries).

UNIT V LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Bali N. P and Manish Goyal, "Text book of Engineering Mathematics", 3rd Edition, Laxmi Publications (p) Ltd., (2008).
2. Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2007).

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics",Tata McGraw Hill Publishing Company, New Delhi, (2007).
2. Glyn James, "Advanced Engineering Mathematics", 3rd Edition, Pearson Education, (2007).
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 7th Edition, Wiley India, (2007).
4. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House Pvt. Ltd., (2007).

PH2161 ENGINEERING PHYSICS – II L T P C
3 0 0 3

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – compound semiconductors – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications – magnetic recording and readout – storage of magnetic data – tapes, floppy and magnetic disc drives.

Superconductivity : properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V MODERN ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications.

Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

Nanomaterials: synthesis –plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling - properties of nanoparticles and applications.

Carbon nanotubes: fabrication – arc method – pulsed laser deposition – chemical vapour deposition - structure – properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Charles Kittel ' Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
2. Charles P. Poole and Frank J.Ownen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES:

1. Rajendran, V, and Marikani A, 'Materials science'Tata McGraw Hill publications, (2004) New delhi.
2. Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).
3. Palanisamy P.K, 'Materials science', Scitech publications(India) Pvt. LTd., Chennai, second Edition(2007)
4. M. Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).

CY2161 ENGINEERING CHEMISTRY – II L T P C
3 0 0 3

AIM

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES

- The student should be conversant with the principles electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I ELECTROCHEMISTRY 9

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} vs dichromate and precipitation – Ag^{+} vs Cl^{-} titrations) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations,

UNIT II CORROSION AND CORROSION CONTROL 9

Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating.

UNIT III FUELS AND COMBUSTION 9

Calorific value – classification – Coal – proximate and ultimate analysis metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and fractions – cracking – catalytic cracking and methods-knocking – octane number and cetane number – synthetic petrol – Fischer Tropsch and Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG, Flue gas analysis – Orsat apparatus – theoretical air for combustion.

UNIT IV PHASE RULE AND ALLOYS 9

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT V ANALYTICAL TECHNIQUES 9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).

ME2151 ENGINEERING MECHANICS L T P C
3 1 0 4

OBJECTIVES:

At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I BASICS & STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lame's theorem, Parallelogram and triangular Law of forces – Vectors – Vectorial representation of forces and moments – Vector operations: additions, subtraction, dot product, cross product – Coplanar Forces – Resolution and Composition of forces – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions – Examples

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of Areas and Volumes – First moment of area and the Centroid of sections – Rectangle, circle, triangle from integration – T section, I section, - Angle section, Hollow section by using standard formula – second and product moments of plane area – Rectangle, triangle, circle from integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Mass moment of inertia – Derivation of mass moment of inertia for rectangular section, prism, sphere from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's law – Work Energy Equation of particles – Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – Belt friction.

Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion.

TOTAL: 60 PERIODS

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol. 2 Dynamics, McGraw-Hill International Edition, (1997).

REFERENCES:

1. Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., (2000).
2. Hibbeller, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., (2000).
3. Palanichamy, M.S., Nagam, S., "Engineering Mechanics – Statics & Dynamics", Tata McGraw-Hill, (2001).
4. Irving H. Shames, "Engineering Mechanics – Statics and Dynamics", IV Edition – Pearson Education Asia Pvt. Ltd., (2003).
5. Ashok Gupta, "Interactive Engineering Mechanics – Statics – A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., (2002).

EE2151 **CIRCUIT THEORY** **L T P C**

(Common to EEE, EIE and ICE Branches) **3 1 0 4**

UNIT I BASIC CIRCUITS ANALYSIS 12

Ohm's Law – Kirchoffs laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS: 12

Network reduction: voltage and current division, source transformation – star delta conversion.

Thevenins and Novton & Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

UNIT III RESONANCE AND COUPLED CIRCUITS 12

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. with sinusoidal input.

UNIT V ANALYSING THREE PHASE CIRCUITS 12

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL :60 PERIODS

TEXT BOOKS:

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis",Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
2. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis",Tata McGraw Hill, (2007).

REFERENCES:

1. Paranjothi SR, "Electric Circuits Analysis," New Age International Ltd., New Delhi, (1996).
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi (2001).
3. Chakrabati A, "Circuits Theory (Analysis and synthesis), Dhanpath Rai & Sons, New Delhi, (1999).
4. Charles K. Alexander, Mathew N.O. Sadik, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, (2003).

EC2151 ELECTRIC CIRCUITS AND ELECTRON DEVICES L T P C
(For ECE, CSE, IT and Biomedical Engg. Branches) **3 1 0 4**

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs – frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES 12

Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

UNIT IV TRANSISTORS 12

Principle of operation of PNP and NPN transistors – study of CE, CB and CC configurations and comparison of their characteristics – Breakdown in transistors – operation and comparison of N-Channel and P-Channel JFET – drain current equation – MOSFET – Enhancement and depletion types – structure and operation – comparison of BJT with MOSFET – thermal effect on MOSFET.

UNIT V SPECIAL SEMICONDUCTOR DEVICES
(Qualitative Treatment only) 12

Tunnel diodes – PIN diode, varactor diode – SCR characteristics and two transistor equivalent model – UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, "Electric Circuits" – Shaum series,Tata McGraw Hill, (2001)
2. S. Salivahanan, N. Suresh kumar and A. Vallavanraj, "Electronic Devices and Circuits",Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, (2008).

REFERENCES:

1. Robert T. Paynter, "Introducing Electronics Devices and Circuits", Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, "Engineering Circuit Analysis",Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, "Electronic Devices & Circuits",Tata McGraw Hill, 2nd Edition, 2008.

GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
3 0 0 3

(Common to branches under Civil, Mechanical and Technology faculty)

UNIT I ELECTRICAL CIRCUITS & MEASURMENTS 12

Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase and Three Phase Balanced Circuits.

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single Phase Transformer, single phase induction Motor.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation.

Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics – Elementary Treatment of Small Signal Amplifier.

UNIT IV DIGITAL ELECTRONICS 12

Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Types of Signals: Analog and Digital Signals – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations.

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS:

1. V.N. Mittle "Basic Electrical Engineering",Tata McGraw Hill Edition, New Delhi, 1990.
2. R.S. Sedha, "Applied Electronics" S. Chand & Co., 2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering",Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press (2005).
3. Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, (2002).
5. Premkumar N, "Basic Electrical Engineering", Anuradha Publishers, (2003).

GE2152 BASIC CIVIL & MECHANICAL ENGINEERING L T P C
(Common to branches under Electrical and I & C Faculty) **4 0 0 4**

A – CIVIL ENGINEERING

UNIT I SURVEYING AND CIVIL ENGINEERING MATERIALS 15

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II BUILDING COMPONENTS AND STRUCTURES 15

Foundations: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

TOTAL : 30 PERIODS

B – MECHANICAL ENGINEERING

UNIT III POWER PLANT ENGINEERING 10

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV I C ENGINES 10

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: 30 PERIODS

REFERENCES:

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”,Tata McGraw Hill Publishing Co., New Delhi, (1996).
2. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
3. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).
4. Venugopal K and Prahu Raja V, “Basic Mechanical Engineering”, Anuradha Publishers, Kumbakonam, (2000).
5. Shantha Kumar S R J., “Basic Mechanical Engineering”, Hi-tech Publications, Mayiladuthurai, (2000).

GE2155 COMPUTER PRACTICE LABORATORY – II **L T P C**
0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS **15**
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING **15**
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX **15**
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS

HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware
- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software
- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

GS2165 PHYSICS LABORATORY – II **L T P C**
0 0 3 2

LIST OF EXPERIMENTS

1. Determination of Young's modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer dispersive power of a prism.
6. Determination of Young's modulus of the material – uniform bending.
7. Torsional pendulum – Determination of rigidity modulus.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

GS2165	CHEMISTRY LABORATORY – II	L T P C 0 0 3 2

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using $BaCl_2$ vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

- **A minimum of FIVE experiments shall be offered.**
- **Laboratory classes on alternate weeks for Physics and Chemistry.**
- **The lab examinations will be held only in the second semester.**

ME2155	COMPUTER AIDED DRAFTING AND MODELING LABORATORY	L T P C 0 1 2 2

List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building (Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
9. Drawing isometric projection of simple objects.
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

EE2155	ELECTRICAL CIRCUIT LABORATORY (Common to EEE, EIE and ICE)	L T P C 0 0 3 2

LIST OF EXPERIMENTS

1. Verification of ohm's laws and kirchoff's laws.
2. Verification of Thevemin's and Norton's Theorem
3. Verification of superposition Theorem
4. Verification of maximum power transfer theorem.
5. Verification of reciprocity theorem
6. Measurement of self inductance of a coil
7. Verification of mesh and nodal analysis.
8. Transient response of RL and RC circuits for DC input.
9. Frequency response of series and parallel resonance circuits.
10. Frequency response of single tuned coupled circuits.

TOTAL: 45 PERIODS

EC2155	CIRCUITS AND DEVICES LABORATORY	L T P C
		0 0 3 2

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac.
12. Characteristics of Photodiode and Phototransistor.

TOTAL : 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional) **L T P C**
0 0 2 -

1. Listening: **5**

Listening & answering questions – gap filling – Listening and Note taking- Listening to telephone conversations

2. Speaking: **5**

Pronouncing words & sentences correctly – word stress – Conversation practice.

Classroom Session **20**

1. Speaking: Introducing oneself, Introducing others, Role play, Debate- Presentations: Body language, gestures, postures.
   Group Discussions etc
2. Goal setting – interviews – stress time management – situational reasons

Evaluation

(1) Lab Session – 40 marks

Listening – 10 marks
Speaking – 10 marks
Reading – 10 marks
Writing – 10 marks

(2) Classroom Session – 60 marks

Role play activities giving real life context – 30 marks
Presentation – 30 marks

Note on Evaluation

1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES:

1. Hartley, Peter, Group Communication, London: Routledge, (2004).
2. Doff, Adrian and Christopher Jones, Language in Use – (Intermediate level), Cambridge University Press, (1994).
3. Gammidge, Mick, Speaking Extra – A resource book of multi-level skills activities , Cambridge University Press, (2004).
4. Craven, Miles, Listening Extra - A resource book of multi-level skills activities, Cambridge, Cambridge University Press, (2004).
5. Naterop, Jean & Rod Revell, Telephoning in English, Cambridge University Press, (1987).

LAB REQUIREMENTS

1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
(Common to all branches) **3 1 0 4**

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I FOURIER SERIES 9+3

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 identify – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 9+3

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+3

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+3

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+3

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

LECTURES: 45 TUTORIALS : 15, TOTAL : 60 PERIODS

TEXT BOOK:

1. Grewal, B.S, "Higher Engineering Mathematic", 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES:

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematic", 7th Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India (2007)

BM 2201 **MEDICAL PHYSICS** **L T P C**
3 0 0 3

AIM

To get the complete understanding of radioactivity and medical applications of various radio isotopes

OBJECTIVES

To Study the effects of sound and light in Human body
To study the effects of radiation in matter and how isotopes are clinically used.

UNIT I **10**

Electromagnetic spectrum and its medical application
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 – Higher frequency effect.

UNIT II **10**

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 radionuclides** – 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 **8**

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 neuron with matter

UNIT IV PHYSICS OF CARDIOPULMONARY SYSTEM **9**

The Airways, - blood and lung interaction – measurement of lung volume – pressure air flow volume relation ships of lungs – physics of alveoli – the breathing mechanism – Major components of cardiovascular system – O2 and CO2 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 **8**

Acute Radiation Effects - The concept of LD 50 – 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 PERIODS

TEXT BOOKS:

1. B.H Brown , PV Law ford, R H Small wood , D R Hose , D C Barber , "Medical Physics and Biomedical Engineering", CRC Press, 1999.
2. Gopal B.Saha "Physics and Radiobiology of Nuclear Medicine" Springer, 3rd ed, 2006

REFERENCES:

1. John R. Cameron and James G. Skofronick, “Medical Physics”, John–Wiley & Sons, 978.
2. RF Farr and PJ Allisy –Roberts, “Physics for Medical Imaging” Saunders, 1997.
3. P.Uma Devi, A. Nagarathnam, B S Satish Rao, “Introduction to Radiation Biology” B.I .Churchill Livingstone pvt ltd, 2000.
4. S.Webb, “The Physics of Medical Imaging”, Taylor and Francis, 1988.

BM 2202 SIGNALS AND SYSTEMS L T P C
3 1 0 4

AIM

To study and analyse characteristics of continuous, discrete signals and systems

OBJECTIVE

- To study the properties and representation of discrete and continuous signals
- To study the properties and representation of discrete and continuous systems
- To study the signals in time domain and frequency domain using Fourier
- To study the sampling process and analysis of signals and systems using Laplace and Z-transforms.
- To study the analysis and synthesis of systems.

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Classification of signals – Continuous-time signal and discrete-time signals – periodic and aperiodic signals – even and odd signals – energy and power signals – deterministic and random signal. Basic operations on signals – arithmetic operations – reflections – time shifting – time scaling. Types of signals – exponential, sinusoidal, step, impulse and ramp. System - impulse response of the system. Classification of systems – stable – memory – invertible – time invariant – linear – causal. Convolution integrals and its properties. Sampling theorem.

UNIT II FOURIER SERIES AND FOURIER TRANSFORM 9

Continuous-time Fourier series (CTFS) – Exponential and trigonometric representation of CTFS. Dirichlet condition. Properties of CTFS – linearity, time-shifting, time-reversal, time-scaling, multiplication, Parseval’s relation – differentiation – integration. Continuous-time Fourier transform (CTFT) – properties of CTFT – linearity, time shifting, time-reversal, time-scaling, multiplication, convolution, Parseval’s relation – differentiation in time and frequency domains– integration. Application to systems - solution to differential equation using CTFT.

Discrete-time Fourier series (DTFS) and Discrete-time Fourier transform (DTFT) – properties – linearity, time-shifting, time-reversal, time-scaling, multiplication, Parseval’s relation – difference – accumulation. Application to systems - solution to difference equation using DTFT.

UNIT III LAPLACE TRANSFORM 9

Unilateral and bilateral Laplace transform (LT) – region of convergence (ROC) - properties of LT – linearity, time-shifting, time-reversal, time-scaling, multiplication, convolution, Parseval's relation – differentiation in time and frequency domain – integration – initial value and final value theorem – inversion of LT – solution to differential equation using LT – analysis of passive network using LT.

UNIT IV DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) 9

Discrete Fourier transform – properties of DFT – linearity, circular-shifting in time and frequency domains, time-reversal, time-scaling, circular correlation, multiplication, convolution, parseval's relation – circular convolution – circle method, matrix method – sectional convolution – overlap-add method and overlap-save method – radix-2 fast Fourier algorithm – decimation-in-time FFT – decimation-in-frequency FFT – inverse FFT.

UNIT V Z-TRANFORM AND STATE MATRIX 9

Z-transform (ZT) – region of convergence (ROC) - properties of ZT – linearity, time-shifting, time-reversal, time-scaling, multiplication, convolution, parseval's relation – differentiation in time and frequency domain – integration – initial value and final value theorem – inversion of ZT – power series method, partial-fraction method, residual method - solution to difference equation using ZT.

State variable description for LTI system – determination of transfer function from state model – discrete-time model.

TEXT BOOK

1. Allan V. Oppenhein et al, "Signals and Systems", Pearson Education, 2007

REFERENCES:

1. Simon Haykin and Barry Van Veen, "Signals and Systems", John Willey, 1999
2. Roger E. Zeimer et al, "Signals and Systems", McMillan, 2nd Edition, 1999.
3. Douglas K. Linder, ""Signals and Systems", McGraw-Hill, 2nd Edition, 1999.

BM 2203 SENSORS AND MEASUREMENTS I L T P C
3 1 0 4

UNIT I SCIENCE OF MEASUREMENT 7

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 11

Strain Gauge: Gauge factor, sensing elements, configuration, unbounded strain gage, biomedical applications; strain gauge as displacement & pressure transducers: force summing devices, capacitive transducer, inductive transducer, LVDT,

Passive types: RTD materials & 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 (PMT), 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 & Ultrasound transducer.

UNIT IV SIGNAL CONDITIONING & 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 & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, servo recorders, photographic recorder, magnetic tape recorder, X–Y recorder, thermal recorder.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Principles of Applied Biomedical Instrumentation L.A Geddas and L.E.Baker – John Wiley and sons.
2. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

REFERENCES:

1. Ernest o Doebelin and dhanesh N manik, Measuremet systems, Application and design ,5th edition ,McGraw-Hill, 2007.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2007.
3. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004

BM 2204 ELECTRONIC CIRCUITS L T P C
3 1 0 4

AIM

The aim of this course is to familiarize the student with analysis and design of basic transistor amplifier circuits, signal generator circuits and power supplies

OBJECTIVES:

On completion of this course, the student will understand

- The methods of biasing transistors,
- Design the simple amplifier circuits, and design of signal generation circuits,
- Advantages and analysis of feed back,
- Design of Power supplies.

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 – Heartly 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 sinking .

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).

TEXT BOOK:

1. Robert L. Boylestad, Louis Nashelsky , Electronic Devices and circuit Theory , Prentice Hall of India , 2004.

REFERENCES:

1. David A. Bell , Electronic Devices And Circuits 4 th Edition Prentice Hall of India, 2003.
2. Millman Haykins, Electronic Devices And Circuits,2nd Edition Tata MC Graw Hill,2007.

BM 2205 BIOCHEMISTRY L T P C
3 0 0 3

AIM

- To study the biochemical reactions and the various methods to analyze them.

OBJECTIVE:

- To give a clear understanding of important biomolecules and their functions.
- To analyze the metabolic pathways in normal and diseased state.
- To help in devising analytical & diagnostic tools.

UNIT I **6**

Introduction to biochemistry – Biomolecules, structure of water & its importance – Important noncovalent forces – Hydrogen bonds, electrostatic, hydrophobic & vanderwaals forces – Acid, base & buffers – pH, Henderson Hasselbalch equation. Biological buffers and their significance – Principle of viscosity – surface tension , adsorption, diffusion, osmosis & their applications in biological systems.

UNIT II **9**

Classification, structure & properties of carbohydrates – mono, di , oligo & olysaccharides. Classification, structure & properties of amino acids & proteins.

Classification, structure & properties of Lipids – Simple lipids , Phospholipids , glycolipids & steroids . Transport of lipids: Lipoproteins Structure & functions of nucleic acids – Nucleosides , nucleotides – Cyclic AMP , cyclic GMP , ATP , GTP – DNA & RNA

UNIT III **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. Introduction to Metabolism: Carbohydrate metabolism, Glycolysis

Lipid metabolism : fatty acid, beta oxidation , ketogenesis and cholesterol metabolism. TCA cycle : Structure of biological membranes, electron transport & Oxidative phosphorylation.

UNIT IV **9**

Liver function and liver function tests, Kidney function and kidney function tests , normal & abnormal constituents of urine and their clinical significance. General characteristics of hormones. Structure , functions & disorders of thyroid , parathyroid , pituitary ,adrenal and pancreatic hormones. Hormones as chemical messengers: General assay of hormones – Bio assay , chemical assay & immuno assays.

UNIT V **9**

Analytical techniques: Principle and applications of electrophoresis – PAGE , SDS PAGE , Isoelectric focusing , Two Dimensional Electrophoresis. Chromatography: Principle of adsorption & partition chromatography, Size exclusion , Ion exchange & affinity chromatography. Spectro photometry, fluorimetry, flame photometry, manometry , microcalorimetry , electrochemical methods, biosensors , automation in clinical laboratory , use of radio isotopes in biochemistry.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Harper's review of biochemistry By David. W. Martin, Peter. A. Mayes , Victor. W. Rodwell . LANGE medical publications, 2003.
2. Practical Biochemistry – Principles & Techniques,Keith Wilson & John Walker. Oxford university press.

REFERENCE S:

1. Understanding Enzymes By Trevor palmer. Published by Ellis Horwood LTD.
2. Biochemistry Lippincott's Illustrated Reviews By Pamela.C.Champe & Richard. A.Harvey. Lippincott-Raven publishers, 3rd edition, 2006.

BM 2206 ANATOMY AND HUMAN PHYSIOLOGY L T P C
3 0 0 3

AIM

To provide the students the exposure to the fundamentals in human anatomy and physiology.

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 in 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.

TEXT BOOK:

1. Essential of human Anatomy and Physiology, Elaine.N. Marieb Eight edition, Pearson Education New Delhi ,2007.

REFERENCES:

1. Review of Medical Physiology,22nd edition,William F.Ganong Mc Graw Hill New Delhi,
2. Text book of Physiology, Prof. A.K. Jain, Third edition volume I and II Avichal Publishing company, New Delhi

BM 2208 BIOCHEMISTRY AND HUMAN PHYSIOLOGY LAB 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 opthalmoscope to view retina.
12. Weber's and Rinnee's test for auditory conduction.

TOTAL: 60 PERIODS

LAB EQUIPMENTS

1) Test tube, microscope (Binocular), colorimeter
2) Centrifuge, Test tubes, anticoagulant
3) Blood Glucose kit
4) Cholesterol kit
5) SGOT/SGPT kit
6) Creatinine kit
7) Electrophoresis apparatus
8) Glass tanks, thin layer chromatography
9) ESR glan tube wintrobe PCV tube(Haematocrit tube) , sahli's Haemo globinometer, Microscope, Haemocytometer(Mirror coated)
10) Differential count Leishman stain(readymade),Blood group antigen ,microscope slides.
11) Ishihara chart, Snellen's chart, Opthalmoscope
12) Weber's and Rinnee's test.

BM 2209 ELECTRONIC CIRCUITS LAB L T P C
0 0 3 2

1. Rectifiers – HWR and FWR (with & without capacitor filter)
2. Zener diode as regulator
3. Study of biasing circuits
   a. 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 Hartely Oscillator
11. Design of Colpit oscillator
12. Study of pulse shaping circuits
    i). Astable Multivibrator
    ii). Monostable Multivibrator

TOTAL: 45 PERIODS

(Common to Electronic and Communication Engineering & Bio Medical Engg.)

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 30 STUDENTS (3 per Batch)

S.No	Name of the Equipments / Components	Quantity Required	Remarks
1	Variable DC Power Supply	10	(0-30V)
2	Fixed Power Supply	5	+ / - 12V
3	CRO	10	30MHz
4	Multimeter	10	Digital
5	Function Generator	5	1 MHz
6	Digital LCR Meter	1	
Consumables (Minimum of 25 Nos. each)			
7	BC107, BF195, 2N2222, BC147, BFW10, SL100		
8	IC 555, LEDs		
9	Resistors 1/4 Watt Assorted		
10	Capacitors		
11	Inductors		
12	Bread Boards		
13	Transformer Diodes, Zener Diodes		

MA2261 **PROBABILITY AND RANDOM PROCESSES** **L T P C**
(Common to ECE & Bio Medical Engineering) **3 1 0 4**

AIM

This course aims at providing the necessary basic concepts in random processes. Knowledge of fundamentals and applications of random phenomena will greatly help in the understanding of topics such as signals & systems, pattern recognition, voice and image processing and filtering theory.

OBJECTIVES:

At the end of the course, the students would

- Have a fundamental knowledge of the basic probability concepts.
- Have a well-founded knowledge of standard distributions which can describe real life phenomena.
- Acquire skills in handling situations involving more than one random variable and functions of random variables.
- Understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- Be able to analyze the response of random inputs to linear time invariant systems.

UNIT I RANDOM VARIABLES 9 + 3

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 VARIBLES 9 + 3

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 + 3

Definition and examples - first order, second order, strictly stationary, wide-sense stationary and ergodic processes - Markov process - Binomial, Poisson and Normal processes - Sine wave process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9 + 3

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

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9 + 3

Linear time invariant system - System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output – white noise.

LECTURES: 45 TUTORIAL: 15 TOTAL: 60

TEXT BOOKS

1. Oliver C. Ibe, "Fundamentals of Applied probability and Random processes", Elsevier, First Indian Reprint (2007) (For units 1 and 2)
2. Peebles Jr. P.Z., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002. (For units 3,4 and 5)

REFERENCES

1. Miller,S.L and Childers, S.L, "Probability and Random Processes with applications to Signal Processing and Communications", Elsevier Inc., First Indian Reprint 2007.
2. H. Stark and J.W. Woods, "Probability and Random Processes with Applications to Signal Processing", Pearson Education (Asia), 3rd Edition, 2002.
3. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw-Hill edition, New Delhi, 2004.
4. Leon-Garcia,A, "Probability and Random Processes for Electrical Engineering", Pearson Education Asia, Second Edition, 2007.
5. Yates and D.J. Goodman, "Probability and Stochastic Processes", John Wiley and Sons, Second edition, 2005.

BM 2251 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, pO2 and pCo2, 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).

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004

REFERENCE

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.
3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.

BM2253 BASICS OF ELECTRICAL ENGINEERING L T P C
3 0 0 3

AIM

To make the students understand the basics of electricity generation and utilization.

OBJECTIVES

- To study the magnetic circuits
- To study the principle and application of transformers
- To study the principle of operation of DC motors
- To study the principle and operation of AC machines
- To study the principle of fractional-kW motors and their applications.

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 DCMOTORS 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 the transformer, calculation of efficiency of transformer, construction and voltage ratio aspects of single phase autotransformer, construction and voltage ratio aspects 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 PERIODS

TEXT BOOKS:

1. D P Kothari and I J Nagrath, “Basic Electrical Engineering”, TMH, 2ed, 2007.
2. P. C Sen, “Principles of Electric machines and power electronics”, John-Wiley & Sons, 2ed, 2007.

REFERENCE:

1. Muhammad Rashid, “Power electronics circuit, devices and applications”, Prentice–Hall of India, 3rd ed, 2004.

BM2254 ANALOG AND DIGITAL ICs L T P C
3 1 0 4

AIM:

To understand the functions of various analog and digital IC and their applications

OBJECTIVES

- To acquire the knowledge about the characteristics and operation of various analog ICs
- To study the application of analog ICs in the designing circuit.
- To study the applications of these Digital ICs.
- To understand the basic of the Digital systems.
- To study the design of the various functional circuits using these ICs.

UNIT I OPERATIONAL AMPLIFIERS 9

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp – inverting and noninverting amplifier, summing, subtracting, 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 ADCs, successive approximation ADC

UNIT IV NUMBER SYSTEMS AND LOGIC GATES 9

Decimal, Binary, Octal and Hexadecimal Numbers.-Conversion between these number systems.- Complements r's and (r-1)'s complements.- 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.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ramakant A. Gayakwad , "Op-AMP and Linear Ics, Prince Hall, 1994
2. M. Morris Mano , "Digital Logic and Computer design " Prentice Hall 1994.

REFERENCES:

1. Robert B.Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation, CRC Press, 2004.
2. Sergio Franco, DESIGN with Operational Amplifiers and analog Integrated circuits, McGraw-Hills
3. Millman , J. Halkis.C.C "Integrated Electronics".McGraw Hill , 1972.
4. John. F. Wakerly, "Digital design principles and practices", Pearson Education,Fourth Edition, 2007 .
5. Charles H. Roth, Jr, "Fundamentals of Logic Design", Fourth edition, Jaico Books, 2002

BM 2252 PATHOLOGY AND MICROBIOLOGY L T P C
3 0 0 3

UNIT I: 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: 9

Fluid and hemodynamic derangements, - edema, normal hypostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock.
Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III : 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: 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: 9

Identification of disease producing organisms, simple stain, Gram stain, AFB stain, Fluorescent techniques, antigen-antibody techniques.

TEXT BOOKS:

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins: Pathologic Basis of diseases. WB Saunders Co. 7th edn-2005.
2. Harsh Mohan: Text book of Pathology. Jaypee publishers. 4th edn. 2000.

REFERENCE:

1. **Underwood JCE**: General and Systematic Pathology Churchill Livingstone 3edn.2000.

MICROBIOLOGY

TEXT BOOK

1. Ananthanarayanan R& Panicker CKJ:Textbook of Microbiology. Orient Longmans.7th ed.2006.
2..Dubey RC and Maheswari DK.A textbook of Microbiology. S Chand,2007.

REFERENCES:

1. Prescott,Harley,Klein.Microbiology.Mc Graw Hill 5th ed. 2002.
2. Manual of Microbiology tools and techniques. Kanika Sharma. Ane's student edition.2007.

BM 2255 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 – Superheterodyne receivers

UNIT II PULSE MODULATION 9

Low pass sampling theorem – Quantisation - PAM – Line coding - PCM, DPCM, DM, ADPCM and ADM, Channel Vocoder,– Time Division Multiplexing, frequency Division Multiplexing

UNIT III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying – BPSK, DPSK, QPSK - Principles of M-ary signaling M-ary PSK & 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 – Synchronisation and tracking - Multiple Access – FDMA, TDMA, CDMA

Tutorial = 15
TOTAL 45+15 = 60 PERIODS

TEXT BOOKS:

1. H Taub, D L Schilling, G Saha, "Principles of Communication Systems" 3/e, TMH, 2007
2. S. Haykin "Digital Communications" John Wiley, 2005

REFERENCES:

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

GE 2021 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

AIM

- The aim of this course is to create awareness in every engineering graduate about the importance of environment, the effect of technology on the environment and ecological balance and make them sensitive to the environment problems in every professional Endeavour that they participates.

OBJECTIVE

- At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of

alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill,NewDelhi, (2006).

REFERENCES BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press (2005)

BM2257 **INTEGRATED CIRCUIT LAB** **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 PERIODS

LIST OF EQUIPMENTS AND COMPONENTS FOR A BATCH OF 30 STUDENTS (3 per Batch)

S.No	Name of the equipments / Components	Quantity Required	Remarks
1	Dual ,(0-30V) variable Power Supply	10	-
2	CRO	9	30MHz
3	Digital Multimeter	10	Digital
4	Function Generator	8	1 MHz
5	IC Tester (Analog/Digital)	2	
6	Bread board	10	
Consumables (Minimum of 25 Nos. each)			
1	IC 741	25	
2	IC NE555	25	
3	LED	25	
4	Potentiometer		
5	Seven Segment Display	25	
6	Capacitor		
7	Resistors 1/4 Watt Assorted	25	
8	Single Strand Wire	25	
9	Encoder and Decoder ICs (IC7445, IC 74147)	25	
10	Multiplexer and Demultiplexer ICs. (IC74150, IC74154)	25	
11	Shift register ICs, Counter ICs	25	
12	IC7400	25	
13	IC7404	25	
14	IC7402		
15	IC7408	25	
16	IC7411	25	
17	IC7432	25	

BM 2258 PATHOLOGY AND MICROBIOLOGY LAB. L T P C
0 0 4 2

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 malyarial 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: 60 PERIODS

(Lab Requirement for a both of Semester)

1) Test tubes, Test tube racks, Bunsen burner(gas),(Benedict's solution, Acetic acid, Sulphosalicylic acid), centrifuge, microscope.
2) Slides, cover slips,H & E stains
3) Microscope
4) Beakers,graded alcohols, acetone,Lmoulds(or maling bodies), paradigm wax, water bath, microtone for section cutting,slides,cover slips,hotair oven,refrigerator to store chemical and ice.
5) whanman filter paper for bleeding time Test tubes.
6) Simple Stain test
   SIMPLE STAIN, Glass Slide Reagents – Methylene blue, Crystal Violet, Cabal Iuschin
7) Gram Stain test SIMPLE GRAM STAIN
   Reagents – Crystal Violet, Gram's Iodine, 95% ethyl alcohol Safranin
   Urine bacterial count/ml exceeding 100,000(10s) denotes urinary tract infection.
   Normal : 0-100 ml Glass Slide
8) AFB Strain test ACID FAST STAIN (ZIEHL – NEELSON METHOD) Reagent – Carbal Iushin, Acid Alcohol, Methylene blue, Glass slide
9) Bone marrow charts

BM2305 DIGITAL SIGNAL PROCESSING L T P C
3 1 0 4

AIM

To study the signal processing methods and processors

OBJECTIVES:

- To study the design techniques of IIR and FIR filters
- To study the structure realization method for IIR and FIR filters
- To study the finite word length effects in signal processing
- To study power spectrum estimation
- To study multirate signal processing

UNIT I FINITE IMPULSE RESPONSE (FIR) FILTER 9

Introduction to FIR filter - phase delay and group delay – linear phase transfer function. Design of FIR filter using Fourier method, Rectangular window, Hanning window, Hamming window, Kaiser window. Design using frequency sampling technique. Structure realization of FIR system – direct form, cascade form, linear phase FIR system.

UNIT II INFINITE IMPULSE RESPONSE (IIR) FILTER 9

Introduction to IIR filter - Impulse-invariant transformation technique – Bilinear transformation technique – frequency transformation in digital domain - design of Butterworth filter and Chebyshev filter (type-1) (restricted to 3rd order). Structure realization of IIR system – lattice structure and lattice-ladder structure.

UNIT III FINITE WORD LENGTH EFFECT IN FIR AND IIR FILTER 8

Quantization of fixed-point and floating-point numbers – product quantization – variance estimation of quantization error – finite word length effect on IIR filter – Product quantization error in IIR filter – mathematical analysis of steady state output noise – dynamic scaling to prevent overflow – limit-cycle oscillation in recursive system – rounding-off error in DFT and FFT computation.

UNIT IV BASICS OF RANDOM SIGNAL PROCESSING (ONLY QUALITATIVE ANALYSIS) 10

Introduction to probability function, joint probability, conditional probability – estimation parameters – joint distribution function, probability density function, ensemble average – mean squared value, variance, standard deviation, moments, correlation, covariance, orthogonality, auto-covariance, auto-correlation, cross-covariance and cross-correlation – stationarity – ergodic – white noise – energy density spectrum – power density spectrum estimation – periodogram – direct method, indirect method, Barlett method – Welch method. Decimator (down sampling) – frequency-domain analysis of decimator – interpolation (up sampling) – frequency-domain analysis of interpolator

UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 9

Programmable DSP – multiplier accumulator – over-flow and under-flow in MAC unit – Van-Neumann architecture – Harvard architecture – cache memory – pipelining – computer configuration – RISC – CISC – addressing modes – replication – TMS320 processor – first to fifth generation (only block diagram approach) – architecture and features.

L: 45, T: 15, TOTAL: 60 PERIODS

TEXT BOOKS:

1. E. C. Ifeachor and B.W. Jervis, “Digital Signal processing – A Practical Approach”, Pearson education, New Delhi, 4th Edition, 2004.
2. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing, Algorithms and Applications”, Pearson education, New Delhi, 4th Edition, 2007.

REFERENCES:

1. Sanjit K. Mitra, “Digital Signal Processing – A computer Based Approach”,TMH, New Delhi, 1998
2. Andreas Antoniou, Digital filter Analysis and Design”, Prentice Hall India
3. R. Rabiner and B. Gold, “Theory and Application of Digital Signal processing”, PHI

BM2301 BIOCONTROL SYSTEMS L T P C
3 1 0 4

AIM

By studying various control systems modeling technique, time response analysis and frequency response analysis , biological control systems can be analysed and understood.

OBJECTIVES:

- To study concept and different mathematical techniques applied in analyzing any given system
- To learn to do the analysis of given system in time domain and frequency domain
- To study the techniques of plotting the responses in both domain analysis
- To study techniques of modeling the physiological systems

UNIT I CONTROL SYSTEM MODELLING 9

Terminology and basic structure of control system, example of a closed loop system, transfer functions, modeling of electrical systems, translational and rotational mechanical systems, electromechanical systems, block diagram and signal flow graph representation of systems, conversion of block diagram to signal flow graph, reduction of block diagram and signal flow graph.

UNIT II RESPONSE ANALYSIS 9

Step and Impulse responses of first order and second order systems, determination of time domain specifications of first and second order systems from its output responses. definition of steady state error constants and its computation, definition of stability, Routh-Hurwitz criteria of stability, root locus technique, construction of root locus and study of stability, definition of dominant poles and relative stability .

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency response, Nyquist stability criterion, Nyquist plot and determination of closed loop stability, definition of gain margin and phase margin, Bode plot, determination of gain margin and phase margin using Bode plot, use of Nichol's chart to compute resonance frequency and band width.

UNIT IV PHYSIOLOGICAL CONTROL SYSTEMS 9

Block diagram representation of the muscle stretch reflex, difference between engineering and physiological control systems, generalized system properties , models with combination of system elements, introduction to simulation.

UNIT V PHYSIOLOGICAL SYSTEM MODELING 9

Linear model of respiratory mechanics, model of chemical regulation of ventilation, linear model of muscle mechanics, model of regulation of cardiac output, model of Neuromuscular reflex motion.

L: 45, T: 15, TOTAL= 60 PERIODS

TEXT BOOKS:

1. M. Gopal "Control Systems Principles and design", Tata McGraw Hill ,2002
2. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 1995
3. Michael C K Khoo, "Physiological control systems", IEEE press, Prentice –Hall of India, 2001.

REFERENCES

1. John Enderle, Susan Blanchard, Joseph Bronzino “Introduction to Biomedical Engineering” second edition, Academic Press, 2005.
2. Richard C. Dorf, Robert H. Bishop,” Modern control systems”,Pearson, 2004

BM2302 DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS-I L T P C
3 0 0 3

UNIT I CARDIAC EQUIPMENTS 9

Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Arrhythmia Simulator, Holter Monitor, Phonocardiography, Plethysmography. Cardiac Pacemaker- Internal and External Pacemaker–Batteries, AC and DC Defibrillator- Internal and External.

UNIT II NEUROLOGICAL EQUIPMENTS 9

Clinical significance of EEG, Multi channel EEG recording system, Epillepsy, Evoked Potential –Visual, Auditory and Somatosensory, MEG (Magneto Encephalon Graph). EEG Bio Feedback Instrumentation.

UNIT III SKELETAL MUSCULAR SYSTEM 9

Sliding theory of contraction, recording and analysis of EMG waveforms, fatigue characteristics , Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT IV RESPIRATORY MEASUREMENT STSTEM 9

Instrumentation for measuring the mechanics of breathing – Spirometer-Lung Volume and vital capacity, measurements of residual volume, pneumotachometer - Airway resistance measurement, Whole body plethysmography, Intra-Alveolar and Thoracic pressure measurements, Apnea Monitor. Types of Ventilators – Pressure, Volume, Time controlled. Flow, Patient Cycle Ventilators, Humidifiers, Nebulizers, Inhalators.

UNIT V SENSORY MEASUREMENT 9

Psycho Physiological Measurements-for testing and sensory Responses, Electro occulograph, Electro retinograph, Audiometer-Pure tone, Speech. EGG (Electrogastrograph), galvanic skin resistance(GSR).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”, Pearson education, 2003.
2. John G.Webster, Medical Instrumentation Application and Design, third edition, Wiley India Edition, 2007.

REFERENCES:

1. Myer Kutz, “Standard Handbook of Biomedical Engineering & Design”, McGraw Hill, 2003.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 2003.

3 L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”,

4 Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Pearson Education, New Delhi, 2007.

BM2303 BIOMATERIALS AND ARTIFICIAL ORGANS L T P C
3 0 0 3

UNIT I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 9

Definition and classification of bio-materials, 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

Polymerization, polyamides, Acryrilic polymers, rubbers, high strength thermoplastics, medical applications. Bio polymers: Collagen and Elastin.

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, Artificial lung (oxygenateor), Artificial Kidney (Dialyser membrane) , Dental Implants.

Total= 45 Periods

TEXT BOOKS:

1. SUJATA V. BHATT, Biomaterials Second Edition ,Narosa Publishing House,2005.
2. BIOMATERIALS - Principles and Applications – Joon B.Park Joseph D. Bronzino, CRC Press, 2003

REFERENCES :

1. PARK J.B., “Biomaterials Science and Engineering”, Plenum Press, 1984.
2. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill, 2003
3. Introduction to Biomedical Engineering – John Enderle, Joseph D. Bronzino, Susan M. Blanchard, Elsevier, 2005.

EC2363 MICROPROCESSOR, MICROCONTROLLER AND SYSTEM DESIGN L T P C
3 0 0 3

UNIT I ARCHITECTURE OF 8085 /8086 9

8085- Functional Block Diagram- Description - Addressing Modes, Timing diagrams.
8086- Architecture, Instruction set, Addressing Modes. Introduction to 8087 - Architecture.

UNIT II 8086 ASSEMBLY LANGUAGE PROGRAMMING 9

Simple Assembly Language Programming, Strings, Procedures, Macros, Assembler Directives- Interrupts and Interrupt Applications.

UNIT III PERIPHERAL INTERFACING & APPLICATION 9

Programmable Peripheral Interface (8255), keyboard display controller (8279), ADC, DAC Interface, Programmable Timer Controller (8254), Programmable interrupt controller (8259), Serial Communication Interface (8251).

UNIT IV MICROCONTROLLER 9

Architecture of 8051 Microcontroller- Instruction Set – Assembly Language Programming – Branching, I/O and ALU Instructions. Programming 8051 - Timers, Serial Port, Interrupts. C programming for 8051.

UNIT V 8086 AND 8051 BASED SYSTEM DESIGN 9

Design and interfacing - LED, LCD & Keyboard Interfacing, ADC, DAC, Sensor Interfacing, External Memory Interfac,e Traffic light controller, Washing machine, RTC Interfacing using I2C Standard, Motor Control, Relay, PWM, DC, Stepper Motor Multichannel biomedical data acquisition system.

TOTAL:45 PERIODS

TEXTBOOKS:

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fourth edition, Penram International Publishing 2006.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming aHardware.Revised second Edition, Indian edition,Tata McGraw Hill, 2007.
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition, Pearson Education 2008.

REFERENCES:

1. Kenneth J.Ayala., "The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, New Delhi, 2007.
2. A.K. Ray , K.M .Bhurchandi "Advanced Microprocessor and Peripherals" ,Second edition, Tata McGraw-Hill, 2007.
3. Barry B.Brey, "The Intel Microprocessors Architecture, Programming and Interfacing" Pearson Education, New Delhi, 2007,
4. Zdravko Karakehayov, "Embedded System Design with 8051 Microcontroller hardware and software", Mercel Dekkar, 1999.
5. Krishna Kant, " Microprocessor and Microcontroller Architecture, programming
    a. and system design using 8085, 8086, 8051 and 8096, PHI, 2007

BM2304 HOSPITAL MANAGEMENT L T P C
3 0 0 3

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning – Equipment Planning – Functional Planning.

UNIT II HUMAN RESOURCE MANAGEMENT ON HOSPITAL 9

Principles of HRM – Functions of HRM – Profile of HRD Manager – Tools of HRD – Human Resource Inventory – Manpower Planning.

UNIT III RECRUITMENT AND TRAINING 9

Different Departments of Hospital, Recruitment, Selection, Training Guidelines – Methods of Training – Evaluation of Training – Leadership grooming and Training, Promotion – Transfer.

UNIT IV PLANNING SUPPORTIVE SERVICES 9

Medical Records Department – Central Sterilization and Supply Department – Pharmacy – Food Services - Laundry Services.

UNIT V COMMUNICATION AND SAFETY ASPECTS IN HOSPITAL 9

Purposes – Planning of Communication, Modes of Communication – Telephone, ISDN, Public Address and Piped Music – CCTV.

Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules.

TOTAL:45 PERIODS

TEXT BOOKS:

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI – Fourth Edition, 2006.
2. G.D.Kunders, "Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007.

REFERENCE:

1. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering, Academic Press, New York, 1977.

BM2306 MICROPROCESSOR AND MICROCONTROLLER LAB L T P C
8085 based experiments 0 0 3 2

1. Assembly Language Programming of 8085

8086 based experiments

1. Programs for 16 bit Arithmetic, Sorting, Searching and String operations,
2. Programs for Digital clock, Interfacing ADC and DAC
3. Interfacing and Programming 8279, 8259, and 8253.
4. Serial Communication between two Microprocessor Kits using 8251.
5. Interfacing and Programming of Stepper Motor and DC Motor Speed control and Parallel Communication between two Microprocessor Kits using Mode 1 and Mode 2 of 8255.
6. Macroassembler Programming for 8086

8051 based experiments

1. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
2. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
3. Interfacing – DAC and ADC and 8051 based temperature measurement
4. Interfacing – LED and LCD
5. Interfacing – stepper motor traffic light control
6. Communication between 8051 Microcontroller kit and PC.

TOTAL:45 PERIODS

Requirement for a batch of 30 students

S. No.	Description of Equipment	Quantity Required	Quantity available	Deficiency %
1.	8085 Trainer Kit	15		
2.	8051 Trainer Kit	15		
3.	8086 Trainer Kit	15		
4.	8255 Addon card (PPI) compatable with 8085/8051/8086	3 Nos.		
5.	8251 Addon card (Serial) compatable with 8085/8051/8086	3 Nos.		
6.	8279 Addon card compatible with 8085/8051/8086	3 Nos.		
7.	Stepper Motor & Interfacing card Compatible	3 Nos.		
8.	ADC x DAC Interfacing card compatible with 8085/8051/8086	3 Nos.		
9.	LED & LCD Interfacing card	3 Nos.		
10.	8086 Macro assembler with PC P(IV)	3 Nos		
11.	Personal Computer	1 No.		

BM2307 BIO MEDICAL INSTRUMENTATION LAB L T P C
0 0 3 2

1. Design of low noise pre-amplifier for ECG
2. Study of characteristics of temperature sensors – thermistor, thermocouple and RTD
3. Measurement of pulse rate using photo transducer
4. Measurement of respiration rate
5. Measurement of blood flow velocity using ultrasound transducer
6. Study of ESU – cutting and coagulation modes
7. pH Measurement and conductivity test
8. Measurement of heart rate using F-V converter
9. Galvanic skin resistance (GSR) measurement
10. Recording of Audiogram

TOTAL:45 PERIODS

Requirement for a batch of 30 students

S. No.	Description of Equipment	Quantity Required	Quantity available	Deficiency %
12.	Low Persistance CRO	3 Nos.		
13.	Low Frequency Oscillator (1 Hz to 5 KHz and above)	5 Nos.		
14.	Digital Multimeter	5 Nos.		
15.	Thermistor, Thermocouple, RTD module with accessories	1 No. each		
16.	Pulse rate measurement setup with accessories	1 No.		
17.	Respiration rate measurement setup with accessories	1 No.		
18.	Ultrasound Doppler flow meter	1 No.		
19.	Electrosurgical unit	1 No.		
20.	GSR Measurement setup with accessories	1 No.		
21.	Audiometer (air conduction, bone conduction test)	1 No.		
22.	P_H meter	1 No.		
23.	Conductivity meter	1 No.		
24.	CRO (0-5 MHz)	5 Nos.		
25.	Op-Amp [µA741 or equivalent]	10 Nos.		

GE2321 COMMUNICATION SKILLS LABORATORY L T P C
(Fifth / Sixth Semester) 0 0 4 2

Globalisation has brought in numerous opportunities for the teeming millions, with more focus on the students' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession

OBJECTIVES:

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

I. PC based session	**(Weightage 40%)**	**24 periods**

A. ENGLISH LANGUAGE LAB (18 Periods)

1. LISTENING COMPREHENSION: 6

Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION: 6

Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.

3. SPEAKING 6

Phonetics: Intonation – Ear training - Correct Pronunciation – Sound recognition exercises – Common Errors in English.

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS (6 PERIODS)
(Samples are available to learn and practice

1. RESUME / REPORT PREPARATION / LETTER WRITING 1

Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS: 1

Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS: 2

Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION: 1

Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS: 1

Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session	**(Weightage – 60%)**	**24 periods**

1. **Resume / Report Preparation / Letter writing**: Students prepare their own resume and report. 2
2. **Presentation Skills:** Students make presentations on given topics. 8
3. **Group Discussion**: Students participate in group discussions. 6
4. **Interview Skills**: Students participate in Mock Interviews 8

REFERENCES:

1. Anderson, P.V, **Technical Communication**, Thomson Wadsworth, Sixth Edition, New Delhi, 2007.
2. Prakash, P, **Verbal and Non-Verbal Reasoning**, Macmillan India Ltd., Second Edition, New Delhi, 2004.
3. John Seely, **The Oxford Guide to Writing and Speaking**, Oxford University Press, New Delhi, 2004.
4. Evans, D, **Decisionmaker**, Cambridge University Press, 1997.
   Thorpe, E, and Thorpe, S, **Objective English**, Pearson Education,
5. Second Edition, New Delhi, 2007.
6. Turton, N.D and Heaton, J.B, **Dictionary of Common Errors**, Addison Wesley Longman Ltd., Indian reprint 1998.

LAB REQUIREMENTS:

1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Sl.No.	Description of Equipment	Quantity required	Quantity available	Deficiency %
1.	**Server**	1 No.		
	o PIV system			
	o 1 GB RAM / 40 GB HDD			
	o OS: Win 2000 server			
	o Audio card with headphones (with mike)			
	o JRE 1.3			
2.	Client Systems	60 No.		
	o **PIII or above**			
	o **256 or 512 MB RAM /40 GB HDD**			
	o **OS: Win 2000**			
	o Audio card with headphones (with mike)			
	o JRE 1.3			

3.	**Softwares**			
	a) Interactive Teacher Control Software	Available / Not Available		
	b) English Language Lab Software	Available / Not Available		
	c) Career Lab software	Available / Not Available		
4.	**Handicam Video Camera (with video lights and mic input)**	1 No.		
5.	Television - 29”	1 No.		
6.	Collar mike	1 No.		
7.	Cordless mikes	1 No.		
8.	Audio Mixer	1 No.		
9.	DVD Recorder / Player	1 No.		
10.	LCD Projector with MP3 /CD /DVD provision for audio / video facility - **Desirable**	1 No.	Available / Not Available	

L: 45, T: 15, TOTAL= 60 PERIODS

BM2351 RADIOLOGICAL EQUIPMENT L T P C
3 0 0 3

AIM

To get the clear understanding of X-ray generation and radio isotopes and various techniques used for visualizing organs in detail.

OBJECTIVES:

To study the functioning of X-ray tubes and scattered radiation and method by which fogginess can be reduced.
To study the different types radio diagnostic unit.
To know the techniques to visualize opaque, transparent organs.
To study the special techniques adopted to visualize different sections of any organ.

UNIT I MEDICAL X-RAY EQUIPMENT - **9**

Nature of X-Rays - X-ray Absorption - Tissue Contrast. X-Ray Equipment (Block Diagram) – X-ray Tube, the collimator, Bucky Grid, power supply. Digital Radiography - discrete digital detectors, storage phosphor and film Scanning. X-Ray Image intensifier tubes - Fluoroscopy – Digital Fluoroscopy. Angiography, Cine angiography. Digital Subtraction Angiography. Mammography.

UNIT II COMPUTER TOMOGRAPHY **9**

Principles of Tomography - First to Fourth generation scanners – Image reconstruction technique- Back projection and Iterative method. Spiral CT Scanning - Ultra fast CT Scanners- X-Ray Sources – Collimation – X-Ray Detectors – Viewing System.

UNIT III MRI **9**

Fundamentals of Magnetic Resonance- Interaction of nuclei with static Magnetic Field and Radio frequency wave – Rotation and Precession –induction of a magnetic resonance signal – bulk Magnetization – Relaxation Processes T1 and T2. Block diagram approach of MRI system- System Magnet (Permanent, Electromagnet and super conductors) , generation of Gradient magnetic Fields , Radio Frequency coils (sending and receiving) Shim coils, Electronic components.

UNIT IV NUCLEAR MEDICINE SYSTEMS **9**

Radio isotopes- alpha, beta and gamma radiations. Radio pharmaceuticals.Radiation detectors - Gas Filled, ionization Chambers, proportional counter, GM counter and Scintillation Detectors. Gamma Camera- Principle of operation, Collimator, Photo multiplier tube, X-Y Positioning Circuit, Pulse height Analyzer. Principles of SPECT and PET.

UNIT V RADIATION THERAPY AND RADIATION SAFETY **9**

Radiation therapy-Linear accelerator, betatron, cesium and cobalt .Radiation Protection in Medicine –Radiation Protection principles, Radiation measuring instruments-Dosimeter, film Badges, Thermo luminescent dosimeters – Electronic dosimeter- ICRP regulation Practical reduction of dose to staff and visitors.

TOTAL :45 PERIODS

TEXT BOOKS:

1. Steve webb, Physics of Medical Imaging, , Taylor and Francis, 1988.
2 R. Hendee and Russell Ritenour “Medical Imaging Physics”–William,Wiley, Fourth Edition 2002.

REFERENCES:

1. Physics and Radiobiology of Nuclear Medicine –Third edition – Gopal B.Saha – Publisher – Springer, 2006.
2. Medical Physics and Biomedical Engineering –B.H Brown , PV Lawford, R H Small wood , D R Hose , D C Barber , CRC Press, 1999.
3. Standard handbook of Biomedical Engineering and Design – Myer Kutz Publisher – McGraw – Hill, 2003.
4. P.Raghunathan, “Magnetic Resonance Imaging and Spectroscopy in Medicine” Concepts and Techniques, Orient Longman, 2007.

BM 2352 BIOMECHANICS L T P C
3 0 0 3

UNIT I INTRODUCTION **9**

Scope of mechanics in medicine, mechanics of bone structure, determination of in-vivo elastic modulus. Biofluid mechanics, flow properties of blood.

UNIT II MECHANICS OF PHYSIOLOGICAL SYSTEMS **9**

Heart valves, power developed by the heart, prosthetic valves. Constitutive equations for soft tissues, dynamics of fluid flow in cardiovascular system and effect of vibration - shear stresses in extra-corporal circuits.

UNIT III ORTHOPAEDIC MECHANICS 9

Mechanical properties of cartilage, diffusion properties of articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, Lubrication of joints.

UNIT IV MATHEMATICAL MODELS 9

Introduction to Finite Element Analysis, Mathematical models - pulse wave velocities in arteries, determination of in-vivo elasticity of blood vessel, dynamics of fluid filled catheters.

UNIT V ORTHOPAEDIC APPLICATIONS 9

Dynamics and analysis of human locomotion - Gait analysis (determination of instantaneous joint reaction analysis), occupant response to vehicular vibration. Mechanics of knee joint during standing and walking.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dhanjoo N. Ghista, “Bio-mechanics of Medical Devices”, Marcel Dekker, 1980.
2. Haufred Clynes, “Bio-medical Engineering Systems”, McGraw Hill, 1998.

REFERENCES:

1. Y.C. Fung, “Bio-Mechanics- Mechanical Properties of Tissues”, Springer-Verlag, 1998.
2. Dhanjoo N. Ghista, “Orthopaedic Mechanics”, Academic Press, 1990.

BM2353 DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS-II L T P C
3 0 0 3

UNIT I ULTRASONIC TECHNIQUE 9

Diagnosis: Basic principles of Echo technique, display techniques A, B and M mode, Application of ultrasound as diagnostic tool – Echocardiogram, abdomen, obstetrics and gynaecology, ophthalmology.

UNIT II PATIENT MONITORING AND BIOTELEMETRY 9

ICU/CCU Equipments, Infusion pumps, bed side monitors, Central consoling controls. Radio Telemetry (single, multi), Portable and Landline Telemetry unit, Applications in ECG and EEG Transmission.

UNIT III DIATHERMY 9

IR and UV lamp and its application. Thermography – Recording and clinical application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level.

UNIT IV EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES 9

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenerators, finger pump, roller pump, electronic monitoring of functional parameter. Haemo Dialyser unit , Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy.

UNIT V PATIENT SAFETY 9

Physiological effects of electricity – important susceptibility parameters – Macro shock – Micro shock hazards – Patient's electrical environment – Isolated Power system – Conductive surfaces – Electrical safety codes and standards – Basic Approaches to protection against shock, Protection equipment design, Electrical safety analyzer – Testing the Electric system

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007
2. John G. Webster, "Medical Instrumentation Application and Design", John Willey and sons, 2002
1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment technology", John Willey and sons, New York, 1997

REFERENCES:

1. Principles of Biomedical Instrumentation and Measurement" – Richard Aston, Merril Publishing Company, 1990
2. Principles of Applied Biomedical Instrumentation L.A Geddas and L.E.Baker – 2004
3. John G. Webster, Bioinstrumentation", John Willey and sons, New York, 2004
4. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw- Hill, New Delhi, 2003.
5. Standard Handbook of Biomedical Engineering & Design – Myer Kutz McGraw-Hill Publisher, 2003

CS2361 INTERNET AND JAVA L T P C
3 0 0 3

UNIT I WORLD WIDE WEB 9

HTTP protocol, Web browsers Netscape, Internet explorer, Web site and web page design,XHTML, Dynamic HTML, CSS.

UNIT II JAVASCRIPT PROGRAMMING 9

Introduction, Control statements, Functions, Arrays and Objects.

UNIT III 9

Micromedia Dream Weaver, XML, Web Servers, Databases – SQL, MYSQL, DBI and ADO.NET

UNIT IV JAVA PROGRAMMING: 9

Language features, Classes, Object and methods. Sub-classing and dynamic binding, Multithreading, Overview of class library, Object method serialization, Remote method invocation, Java Servelets and Javaserver pages.

UNIT V WEB DESIGN AND MEDICAL STANDARDS 9

Web Design case studies – Design and development of Dynamic Hospital Information System Web sites using Macromedia Dreamweaver, Java, XML, Javascript, Programming Techniques. HL7 Standards, DICOM standards.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Deitel, Internet and World Wide Web, Pearson Education / PHI, 2007
2. Deitel, "Java How to Program", Pearson Education / PHI, 2006.
3. Herbert Schildt, The complete Reference JAVA 2, Fifth Edition, Tata McGRaw Hill Publishing Com.Ltd, New Delhi.
4. Achyut S Godbole and Atul Kahate, Web Technologies, TCP / IP to Internet Application Architecture, TMH, 2007.

REFERENCES:

1. Margaret Levine Young, "Internet The Complete Reference", Tata McGraw Hill, 1999.
2. Cay S. Horstmann & Gary Cornell, Core Java^{tm} Volume – I & II, Pearson Education, 2006.
3. Balagurusamy.E.`Programming with Java, A premier` Second Edition, Tata McGraw Hill,2006

BM2356	**DIGITAL SIGNAL PROCESSING LAB**	**L T P C**
		0 0 3 2

MATLAB / Equivalent Software Package(30% of the course)

1. Generation of sequences (functional & random), correlation and convolution
2. Spectrum Analysis using FFT
3. Filter Design & Analysis
4. Filter Implementation in time-domain & frequency domain
5. Study of Quantization errors in DSP algorithms
6. Multirate Filters
7. Adaptive filter
8. Equalization
9. Echo Cancellation

DSP Processor Implementation (70% of the course)

1. Waveform Generation
2. FIR Implementation
3. IIR Implementation
4. FFT
5. Finite word Length effect
6. Multirate filters

CS2362 INTERNET AND JAVA PROGRAMMING LABORATORY L T P C
0 0 3 2

Programs using basic elements and design of Web pages, hyperlinks and web navigation using HTML, XHTML and CSS.
Java script programs using control statements, functions, arrays and objects and applications in web environment
Macromedia Dreamweaver platform to design and develop web pages, insert images and links into web pages, create XHTML elements to be able insert script into Dreamweaver pages and site management
Programs relating to relational database model, database queries using SQL, MYSQL database server and interfaces
Java programming using GUI components, java applet applications, servelets and java server pages.
Design and development of a web based dynamic Hospital Information System

TOTAL : 60 PERIODS

BM2355 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LAB LT P C
0 0 3 2

Recording and analysis of ECG signals
Recording and analysis of EEG signals.
Recording - Fatigue test of EMG signals.
Simulation of ECG – detection of QRS complex and heart rate
Study of Pacemaker simulator
Study of Defibrillator simulator
Study of shortwave and ultrasonic diathermy.
Study of biotelemetry
Electrical safety measurements.
Mini project

TOTAL : 60 PERIODS

BM2401 PATTERN RECOGNITION AND NEURAL NETWORKS L T P C
3 0 0 3

UNIT I INTRODUCTION AND SIMPLE NEURAL NET 9

Elementary neurophysiology and biological neural network-Artificial neural network – Architecture, biases and thresholds, Hebb net, Perceptron, Adaline and Madaline.

UNIT II BACK PROPOGATION AND ASSOCIATIVE MEMORY 9

Back propogation network, generalized delta rule, Bidirectional Associative memory, Hopefield network

UNIT III NEURAL NETWORKS BASED ON COMPETITION 9

Kohonen Self organising map, Learning Vector Quantisation, counter propogation network.

UNIT IV UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS 9

Patterns and features, training and learning in pattern recognition, discriminant functions, different types of pattern recognition. Unsupervised learning- hierarchical clustering, partitional clustering. Neural pattern recognition approach – perceptron model

UNIT V SUPERVISED LEARNING USING PARAMETRIC AND NON PARAMETRIC APPROACH **9**

Bayesian classifier, non parametric density estimation, histograms, kernels, window estimators, k-nearest neighbour classifier , estimation of error rates.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Hagan, Demuth and Beale, “Neural network design”, Vikas Publishing House Pvt. Ltd., New Delhi , 2002
2. Freeman J.A., and Skapura B.M, " Neural networks, algorithms, applications and programming techniques”, Addison – Wesley,2003
3. Duda R.O, Hart P.G, “Pattern classification and scene analysis”, Wiley Edition,2000
4. Earl Gose, Richard Johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.

REFERENCES:

1. Robert Schalkoff, “ Pattern recognition, Statistical, Structural and neural approaches” John Wiley and Sons(Asia) Pte. Ltd., Singapore, 2005
2. Laurene Fausett ,” Fundamentals of neural networks – Architectures, algorithms and applications”, Prentice Hall, 1994.

BM2402 MEDICAL INFORMATICS **L T P C**
3 0 0 3

UNIT I MEDICAL INFORMATICS **9**

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERISED PATIENT RECORD **9**

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT III COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING **9**

Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, Computer assisted medical imaging- nuclear medicine, ultrasound imaging ultrasonography-computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING **9**

Neuro computers and Artificial Neural Networks application, Expert system - General model of CMD, Computer –assisted decision support system-production rule system-cognitive model, semester networks , decisions analysis in clinical medicine-computers in the care of critically patients-computer assisted surgery-designing

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual reality applications in medicine, Computer assisted surgery , Surgical simulation , Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health - Medical education and health care information.

TEXT BOOKS:

1.R.D.Lele Computers in medicine progress in medical informatics, Tata Mcgraw Hill Publishing computers Ltd,2005, New Delhi
2.Mohan Bansal, Medicl informatics Tata Mcgraw Hill Publishing computers Ltd, 2003 New Delhi

BM2403 MEDICAL OPTICS L T P C
3 0 0 3

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, polarizer, 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 TOMOGRAPHY 9

Optical coherence tomography, Elastrography, Doppler optical coherence tomography, Application towards clinical imaging.

UNIT V SPECIAL OPTICAL TECHNIQUES 9

Near field imaging of biological structures, in vitro clinical diagnostic, fluorescent spectroscopy, photodynamic therapy.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Tuan Vo Dirh, “Biomedical photonics – Handbook”, CRC Press, Bocaraton, 2003
2. Mark E. Brezinski., Optical Coherence Tomography: Principles and Applications,Academic Press, 2006.

REFERENCES:

1. Leon Goldman, M.D., & R. James Rockwell, Jr., “Lasers in Medicine”, Gordon and Breach, Science Publishers Inc., New York, 1971
2. R. Splinter and B.A Hooper, An Introduction to BioMedical Optics,Taylor and Francis,2007.

BM2404 **DIGITAL IMAGE PROCESSING** **L T P C**
3 0 0 3

AIM

To study the image processing techniques

OBJECTIVE

- To study the image fundamentals and image transforms
- To study the image enhancement techniques
- To study the image restoration procedures
- To study the image compression procedures

UNIT I DIGITAL IMAGE FUNDAMENTAL 9

Elements of digital image processing systems - Elements of visual perception – image sampling and quantization – basic relationships between pixels - matrix and singular value representation of discrete images.

UNIT II IMAGE TRANSFORMS 9

1-D DFT - 2-D DFT – DCT – DST – Walsh - Hadamard – Haar – Slant – KL – SVD and their properties.

UNIT III IMAGE ENHANCEMENT 9

Gray level transformation – Histogram processing – enhancement using arithmetic/logic operation – spatial filtering – smoothening and sharpening spatial filter – smoothening in frequency domain filter – homomorphic filtering

UNIT IV IMAGE RESTORATION AND RECOGNITION 9

Image degradation models – unconstrained and constrained restoration – inverse filtering – LMS filter – geometric mean filter – geometric transformation – pattern classes – optimal statistical classifier – neural networks and its uses in image processing.

UNIT V IMAGE COMPRESSION 9

Image compression models – elements of information theory – error free compression – lossy compression – run-length – Huffman coding – shift codes – arithmetic coding – bit plane coding – transform coding – JPEG standards – MPEG standards - wavelet transform – predictive techniques – block truncation coding schemes – facet modeling.
Image segmentation – detection of discontinuities – edge linking and boundary detection – thresholding – region based segmentation – segmentation by morphological watersheds – use of motion in segmentation.

TEXT BOOKS:

1) Rafel C. Gonzalez and Richard E. Woods, “Digital Image Processing" Pearson education, 2007.
2) Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 1997

REFERENCES:

1. Willian K. Pratt, “Digital Image Processing”, John Wiley, NJ, 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, NJ, 1998.

BM2406 DIGITAL IMAGE PROCESSING LAB L T P C
0 0 3 2

1. Display of Grayscale Images.
2. Histogram Equalization.
3. Non-linear Filtering.
4. Edge detection using Operators.
5. 2-D DFT and DCT.
6. Filtering in frequency domain.
7. Display of color images.
8. conversion between color spaces.
9. DWT of images.
10. Segmentation using watershed transform.

REFERENCE:

Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing using MATLAB', Pearson Education, Inc., 2004.

TOTAL : 60 PERIODS

BM2021 BIOFLUIDS AND DYNAMICS L T P C
3 0 0 3

UNIT I **10**

BIO-FLUID MECHANICS: Newton's laws, Stress, Strain, Elasticity, Hooks-law, viscosity, Newtonian fluid, Non-Newtonian fluid, Viscoelastic fluids, vascular tree, Relationship between diameter, velocity and pressure of blood flow, Resistance against flow. BIOVISCOELASTIC FLUID: Viscoelasticity - Viscoelastic models, Maxwell, Voigt and Kelvin Models, Response to Harmonic variation, Use of viscoelastic models, Bio-Viscoelastic fluids: Protoplasm, Mucus, Saliva, Synovial fluids.

UNIT II **10**

FLOW PROPERTIES OF BLOOD: Physical, Chemical and Rheological properties of blood. Apparent and relative viscosity, Blood viscosity variation: Effect of shear rate, hematocrit, temperature, protein contents of blood. Casson's equation, Problems associated with extracorporeal blood flow. RHEOLOGY OF BLOOD IN MICROVESSELS: Fahraeus -Lindquist effect and inverse effect, distribution of suspended particles in a narrow rigid tube. Nature of red blood cells in tightly fitting tubes, hematocrit in very narrow tube.

UNIT III **9**

CARDIAC MECHANICS: Cardiovascular system. Mechanical properties of blood vessels: arteries, arterioles, capillaries and veins. Blood flow: Laminar and
Turbulent, Physics of cardiovascular diseases, Prosthetic heart valves and replacements. RESPIRATORY MECHANICS: Alveoli mechanics, Interaction of Blood and Lung P-V curve of Lung: Breathing mechanism, Airway resistance, Physics of Lung diseases.

UNIT IV **8**

SOFT TISSUE MECHANICS: Pseudo elasticity, non-linear stress-strain relationship, Viscoelasticity, Structure, function and mechanical properties of skin, ligaments and tendons.

UNIT V **8**

ORTHOPEDIC MECHANICS: Mechanical properties of cartilage, diffusion properties of Articular cartilage, mechanical properties of bone, kinetics and kinematics of joints, lubrication of joints.

TEXT BOOKS:

1. Y.C Fung, Biomechanics- Mechanical properties of living tissues,2nd ed, Springer-Verlag, 1993.
2. D.O Cooney, Biomedical engineering Principles. Marcel Dekker, INC New York.1976.

REFERENCE:

1. Silver Frederick H. Biomaterials, Medical Devices & Tissue Engineering: Chapman & Hall, London, 1994
2. Biomechanics by Nihanth ozkai, D.A Mc Donald, Blood flow in arteries, Edward Arnold ltd, 1998

BM 2022 **BIOMETRIC SYSTEM** **L T P C**
3 0 0 3

UNIT I BIOMETRIC FUNDAMENTALS **9**

Key Biometric terms and Processes – Definitions-verification and identification – matching, Accuracy in Biometric Systems – False match rate - False nonmatch rate - Failure to enroll rate – Derived metrics - An Introduction to Biometric Authentication Systems- a taxonomy of application environment, a system model, biometrics and privacy.

UNIT II FINGERPRINT IDENTIFICATION TECHNOLOGY **9**

History, Components, Application of Fingerprints, The Technology- Finger Scan Strengths and Weaknesses, Criminal Applications, Civil Applications, Commercial Applications, Technology Evaluation of Fingerprint Verification Algorithms.

UNIT III IRIS RECOGNITION **9**

Introduction, Anatomical and Physiological underpinnings, Components, Sensing, Iris Scan Representation and Matching, Iris Scan Strengths and Weaknesses, System Performance, Future Directions.

UNIT IV FACE RECOGNITION **9**

Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition-Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.

UNIT V VOICE SCAN **9**

Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.

TEXT BOOKS:

1. James Wayman & Anil Jain, Biometric Systems – Technology, Design and Performance Evaluation, Springer-verlag London Ltd, USA, 2005
2. Sanir Nanavati, Michael Thieme, Biometrics Identity Verification in a Networked world, Wiley Computer Publishing Ltd, New Delhi,2003.

REFERENCE:

1. John D. Woodword Jr., Biometrics, Dreamtech Press, New Delhi,2003.

CS2068 DATA STRUCTURES AND OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

UNIT I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 9

Introduction- Tokens-Expressions-contour Structures –Functions in C++, classes and objects, constructors and destructors ,operators overloading and type conversions .

UNIT II ADVANCED OBJECT ORIENTED PROGRAMMING 9

Inheritance, Extending classes, Pointers, Virtual functions and polymorphism, File Handling Templates ,Exception handling, Manipulating strings.

UNIT III DATA STRUCTURES & ALGORITHMS 9

Algorithm, Analysis, Lists, Stacks and queues, Priority queues-Binary Heap-Application, Heaps, skew heaps, Binomial –hashing-hash tables without linked lists

UNIT IV NONLINEAR DATA STRUCTURES 9

Trees-Binary trees, search tree ADT, AVL trees splay Trees, B-trees, Sets and maps in standard Library, Graph Algorithms-Topological sort, shortest path algorithm network flow problems-minimum spanning tree applications of depth-first-search-Introduction to NP - completeness.

UNIT V SORTING AND SEARCHING 9

Sorting – Insertion sort, Shell sort, Heap sort, Merge sort, Quick sort, Indirect sorting, Bucket sort, External sorting, Disjoint set class, Algorithm Design Techniques –Greedy algorithm, Divide and Conquer, Dynamic Programming, Randomized Algorithm, Back tracking algorithm.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 3rd ed, Pearson Education Asia, 2007.
2. E. Balagurusamy, " Object Oriented Programming with C++", McGraw Hill Company Ltd., 2007.

REFERENCES:

1. Michael T. Goodrich, "Data Structures and Algorithm Analysis in C++", Wiley student edition, 2007.
2. Sahni, "Data Structures Using C++", The McGraw-Hill, 2006
3. Sourav Sahay, object oriented programming with C++, Oxford University Press, New Delhi,2006.
4. Seymour, "Data Structures", The McGraw-Hill, 2007.

EC2303 COMPUTER ARCHITECTURE AND ORGANIZATION L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Computing and Computers, Evolution of Computers, VLSI Era, System Design - Register Level, Processor Level, CPU Organization, Data Representation, Fixed – Point Numbers, Floating Point Numbers, Instruction Formats, Instruction Types. Addressing modes.

UNIT II DATA PATH DESIGN 9

Fixed Point Arithmetic, Addition, Subtraction, Multiplication and Division, Combinational and Sequential ALUs, Carry look ahead adder, Robertson algorithm, booth's algorithm, non-restoring division algorithm, Floating Point Arithmetic, Coprocessor, Pipeline Processing, Pipeline Design, Modified booth's Algorithm

UNIT III CONTROL DESIGN 9

Hardwired Control, Microprogrammed Control, Multiplier Control Unit, CPU Control Unit, Pipeline Control, Instruction Pipelines, Pipeline Performance, Superscalar Processing, Nano Programming.

UNIT IV MEMORY ORGANIZATION 9

Random Access Memories, Serial - Access Memories, RAM Interfaces, Magnetic Surface Recording, Optical Memories, multilevel memories, Cache & Virtual Memory, Memory Allocation, Associative Memory.

UNIT V SYSTEM ORGANIZATION 9

Communication methods, Buses, Bus Control, Bus Interfacing, Bus arbitration, IO and system control, IO interface circuits, Handshaking, DMA and interrupts, vectored interrupts, PCI interrupts, pipeline interrupts, IOP organization, operation systems, multiprocessors, fault tolerance, RISC and CISC processors, Superscalar and vector processor.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. John P.Hayes, 'Computer architecture and Organisation', Tata McGraw-Hill, Third Edition, 1998.
2. V.Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, " Computer Organisation", V edition, McGraw-Hill Inc, 1996.

REFERENCES:

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000.
   Paraami, "Computer Architecture", BEH R002, Oxford Press.
2. .P.Pal Chaudhuri, , "Computer organization and design", 2nd Ed., Prentice Hall of India, 2007.
3. G.Kane & J.Heinrich, ' MIPS RISC Architecture ', Englewood cliffs, New Jersey, Prentice Hall, 1992.

GE2071 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 (i). Movable Property ii. Immovable Property and iii. 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 PERIODS

TEXT BOOKS:

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.

GE2072 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; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

BM2023 **PHYSIOLOGICAL MODELLING** **L T P C**
3 0 0 3

UNIT I PROPERTIES OF SYSTEMS AND ELECTRICAL ANALOG 9

System concept, system properties – Resistance, storage, resistance – compliance, piece-wise linear approximation, electrical analog for compliance, thermal storage, step response of first order systems – resistance- compliance systems, and pulse response of first order systems

UNIT II TRANSFER FUNCTIONS 9

Transfer functions and its use, Study of transfer function of first order and second order systems, engineering concept in coupled system, example of Transformed signals.

UNIT III IMPEDANCE CONCEPT 9

Transfer functions with impedance concept, prediction of performance, identification of the system from impedance function, periodic signals, relationship between transfer function and sinusoidal response, evaluation of transfer function from frequency response.

UNIT IV FEEDBACK SYSTEMS 9

Characteristics of physiological feedback systems, stability analysis of systems.

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 : 45PERIODS

REFERENCES

1. William B.Blesser, " System approach to Bio-medicine", McGraw-Hill book co., New York, 1969.
2. Manfred Clynes and John H.Milsum, "Bio-medical engineering system", McGraw-Hill book co., NewYork, 1970.
3. Michael C.K. Khoo," Physiological Control Systems -Analysis, Simulation and Estimation" Prentice Hall of India Pvt. Ltd., New Delhi, 2001
4. Douglas S.Regs, "Control theory and physiological feedback mechanism", The William & Williams co., Baltimore, 1970.*****

BM2024 BIOINFORMATICS L T P C
3 0 0 3

UNIT I BIOINFORMATICS 9

Introduction, Overview of structural Bioinforamtics ; Characteristics, Categories, Navigation and information retrieval of Bioinformatics databases,

UNIT II DATABASES 9

Description and Organisation of Sequence, Structure and Other databases; Database Warehousing and data mining in Bioinformatics.

UNIT III TOOLS 9

Need for tools, Knowledge discovery, Industry trends and data mining tools; Data submission tools, Data analysis tools, Prediction tools and modeling tools.

UNIT IV MACHINE LEARNING IN BIOINFORMATICS 9

Neural network, Genetic and fuzzy logic applications in Bioinformaitcs; Modeling for Bioinformatics – Hidden Markov, Comparative, probabilistic and molecular modeling

UNIT V ALGORITHMS 9

Classification algorithms, implementing algorithms , biological algorithms, bioinformatics tasks and corresponding algorithms and algorithms and bioinformatics software; Data analysis algorithms – Sequence comparison, Substitution matrices and sequence alignment optimal algorithm; Prediction algorithms – Gene prediction, Phylogenetic prediction and protein structure prediction algorithms.

TEXT BOOKS:

1. Orpita Bosu and Simminder Kaur Thukral, Bioinformatics Databases, Tools and Algorithms, Oxford University press, New Delhi, 2007.
2. Yi – Ping Phoebe Chen, Bioinformatics Technolgies, Springer International Edition, New Delhi, 2007.

REFERENCES:

1. Harshawardhan P.Bal, Bioinformatics principles and applications, TataMcGraw Hill Publishing Company Ltd, New Delhi, 2007.
2. Kenneth Baclawski, Tianhua Niu, Bioinformatics, Jaico Publishing House, Delhi, 2007.
3. Lukas K. Beehler and Hooman H. Rashidi, Bioinformatics basics Applications in biological science and medicine, Taylor and Francis Group, 2005,

EC2352 COMPUTER NETWORKS L T P C
3 0 0 3

AIM

To introduce the concept, terminologies, and technologies used in modern data communication and computer networking.

OBJECTIVES:

1. To introduce the students the functions of different layers.
2. To introduce IEEE standard employed in computer networking.
3. To make students to get familiarized with different protocols and network components.

UNIT I PHYSICAL LAYER 9

Data Communications – Networks - Networks models – OSI model – Layers in OSI model – TCP / IP protocol suite – Addressing – Guided and Unguided Transmission media
Switching: Circuit switched networks – Data gram Networks – Virtual circuit networks Cable networks for Data transmission: Dialup modems – DSL – Cable TV – Cable TV for Data transfer.

UNIT II DATA LINK LAYER 10

Data link control: Framing – Flow and error control –Protocols for Noiseless and Noisy Channels – HDLC
Multiple access: Random access – Controlled access
Wired LANS : Ethernet – IEEE standards – standard Ethernet – changes in the standard – Fast Ethernet – Gigabit Ethernet.
Wireless LANS : IEEE 802.11–Bluetooth.
Connecting LANS: Connecting devices - Backbone networks - Virtual LANS
Virtual circuit networks: Architecture and Layers of Frame Relay and ATM.

UNIT III NETWORK LAYER 9

Logical addressing: IPv4, IPv6 addresses

Internet Protocol: Internetworking – IPv4, IPv6 - Address mapping – ARP, RARP, BOOTP, DHCP, ICMP, IGMP, Delivery - Forwarding - Routing – Unicast, Multicast routing protocols.

UNIT IV TRANSPORT LAYER 7

Process-to-Process delivery - User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QoS) – Techniques to improve QoS.

UNIT V APPLICATION LAYER 10

Domain Name System (DNS) – E-mail – FTP – WWW – HTTP – Multimedia

Network Security: Cryptography – Symmetric key and Public Key algorithms - Digital signature – Management of Public keys – Communication Security – Authentication Protocols.

TOTAL : 45PERIODS

TEXT BOOKS

1. Behrouz A. Foruzan, “Data communication and Networking”, Tata McGraw-Hill,: Unit I – IV, 2006.
2. Andrew S. Tannenbaum, “Computer Networks”, Pearson Education, Fourth Edition, : Unit V, 2003.

REFERENCES:

1. Wayne Tomasi, “Introduction to Data Communication and Networking”, 1/e, Pearson Education.
2. James .F. Kurouse & W. Rouse, “Computer Networking: A Topdown Approach Featuring”,3/e, Pearson Education.
3. C.Sivaram Murthy, B.S.Manoj, “Ad hoc Wireless Networks – Architecture and Protocols”, Second Edition, Pearson Education.
4. Greg Tomshon, Ed Tittel, David Johnson. “Guide to Networking Essentials”, fifth edition, Thomson India Learning, 2007.
5. William Stallings, “Data and Computer Communication”, Eighth Edition, Pearson Education, 2000.

CS2069 COMPUTER HARDWARE, INTERFACING AND INSTRUMENTATION L T P C 3 0 0 3

UNIT I INTEL ADVANCED PROCESSORS 7

80186, 80286- Architecture, Programming enhancements, 80c188EB interfacing

UNIT II INTEL 80386, 80486 PROCESSOR 10

80386- Introduction, Special 80386 registers, Memory management, Protected mode, virtual 8086 mode, memory paging mechanism, 80486 Microprocessor – Introduction and architecture.

UNIT III PENTIUM PROCESSORS 10

Pentium Architecture- Memory Management- New Pentium instructions - Pentium Pro microprocessors - Pentium II, Pentium III, Pentium 4- Special Features and Software changes.

UNIT IV PC HARDWARE OVERVIEW 10

Functional Units & Interconnection, New Generation Mother Boards 286 to Pentium 4 Bus Interface- ISA- EISA- VESA- PCI- PCIX., Memory and I/O Port Addresses, Peripheral Interfaces and Controller.

UNIT V PC BASED DATA ACQUISITION 8

Plug-in data acquisition and control boards and programming – ADC, DAC, Digital I/O board and Timing board, Serial port and parallel port programming. Data acquisition and programming using serial interfaces – PC and microcontroller serial ports, USB and IEEE 1394.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. B.B.Brey The Intel Microprocessor 8086/8088/80186/80188,80286,80386, 80486 Pentium, Pentium Pro, PII, PIII & IV Archietecture, Programming & Interfacing, Pearson India, 2007.
2. B.Govindarajulu, IBM PC and clones Hardware, Trouble Shooting and Maintenance, Second Edition, Tata McGraw Hill, New Delhi, 2005.
3. N.Mathivanan, PC-Based Instrumentation concepts and practice, Prentice Hall of India, New Delhi, 2007.

REFERENCES:

1. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition, Indian edition, Tata McGraw Hill, New Delhi, 2007.
2. A.K.Ray, K.M. Bhurchandi, “Advanced microprocessors and peripherals”, II Edition, Tata McGraw Hill 2006.

BM2027 REFRIGERATION AND AIR CONDITIONING L T P C
3 0 0 3

UNIT I REFRIGERATION CYCLES & REFRIGERANTS 9

Vapour Compression Refrigeration Cycle-Simple saturated vapour compression Refrigeration cycle.Thermodynamic analysis of the above. Refrigerant Classification, Designation, Alternate Refrigerants, Global Warming Potential & Ozone Depleting Potential aspects.

UNIT II SYSTEM COMPONENTS 9

Refrigerant Compressors - Reciprocating Open & Hermetic type, Screw Compressors and Scroll Compressors -Construction and Operation characteristics. Evaporators - DX coil, Flooded type Chillers Expansion devices -Automatic Expansion Valves, Capillary Tuber & 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 Airconditioning, Cooling Load Calculations, Air Distribution Patterns, Dynamic and Frictional Losses in Air Ducts, Equal Friction Method, Fan Characteristics in Duct Systems.

TOTAL : 45 PERIODS

TEXT BOOK:

1. W.F.Stocker and J.W.Jones, "Refrigeration & Air Conditioning " McGraw Hill Book CompXany, 1985.

REFERENCES:

1. R.J.Dossat, "Principles of Refrigeration ", John Wiley and Sons Inc., 2 ed, 2003.
2. Dr.S.S.Thipse, “Refrigeration and Air Conditioning”, Jaico Publishing House, 2007.
3. Manohar Prasad, "Refrigeration and Air Conditioning ", Wiley Eastern Ltd., 1995.

GE2022 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT IV QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Dale H.Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

EC2038 NANO ELECTRONICS L T P C
3 0 0 3

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size – surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope – scanning electron microscope – atomic force microscope – scanning tunnelling microscope – nanomanipulator – nanotweezers – atom manipulation – nanodots – self assembly – dip pen nanolithography. Nanomaterials: preparation – plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling – applications of nanomaterials;

UNIT II FUNDAMENTALS OF NANOELECTRONICS 9

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing – DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

UNIT III SILICON MOSFETs & QUANTUM TRANSPORT DEVICES 9

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts.

Quantum transport devices based on resonant tunneling:- Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications:- Single electron devices – applications of single electron devices to logic circuits.

UNIT IV CARBON NANOTUBES 9

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic propertics – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of an all carbon nanotube nanoelectronics.

UNIT V MOLECULAR ELECTRONICS 9

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices.

TOTAL: 45 Hrs.

TEXTBOOKS:

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002
2. T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007
3. Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003

BM 2029 BIOMEMS L T P C
3 0 0 3

UNIT I MEMS AND MICROSYSTEMS 9

Typical MEMs and Microsystems, , materials for MEMS - active substrate materials- Silicon and its compounds, Silicon piezoresistors, Gallium Arsenide, quartz, polymers. Micromachining- photolithography, thin film deposition, doping, etching, bulk machining, wafer bonding, LIGA

UNIT II MICROSENSORS AND ACUATORS 9

Mechanics for MEMs design- static bending of thin plates,mechanical vibration, thermomechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – microplates, strain, pressure and flow measurements, gyroscope, piezoactuator.Thermal sensors and actuators- micromachined thermocouple probe, Peltier effect hat pumps, thermal flow sensors

UNIT III MICRO OPTO ELECTRO MECHANICAL SYSTEMS 9

Fundamental principle of MOEMS technology, light modulators, beam splitter, microlens, digital micromirror devices, light detectors, grating light valve, optical switch

UNIT IV MICROFLUIDIC SYSTEMS 9

Fluid dynamics, continuity equation, momentum equation, equation of motion, laminar flow in circular conduits, fluid flow in microconduits, in submicrometer and nanoscale. Microscale fluid, expression for liquid flow in a channel, fluid actuation methods, dielectriophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system

UNIT V BIOMEMS 9

CAD for MEMs, Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR), DNA hybridization

TEXT BOOKS:

1. Nitaigour Premchand Mahalik, " MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007
2. Tai Ran Hsu , "MEMS and Microsystems design and manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002
3. Wanjun Wang, Stephen A.Soper,"BioMEMs: Technologies and applications", CRC Press, New York, 2007

BM2025 ASSIST DEVICES L T P C
3 0 0 3

AIM

To understand functioning and usage of electromechanical units which will restore normal functional ability of particular organ which is defective temporarily or permanently.

OBJECTIVES:

- To study various mechanical techniques that will help failing heart.
- To study the functioning of the unit which does the clearance of urea from the blood.
- To understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
- To study the various orthodic devices and prosthetic devices to overcome orthopaedic problems.
- To understand electrical stimulation techniques used in clinical applications.

UNIT I CARDIAC ASSIST DEVICES 9

Principle of External counter pulsation techniques, intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves.

UNIT II HEMODIALYSERS 9

Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT III HEARING AIDS 9

Common tests – audiograms, airconduction, boneconduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV PROSTHETIC AND ORTHODIC DEVICES 9

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthodic system, functional electrical stimulation, sensory assist devices.

UNIT V RECENT TRENDS 9

Transcutaneous electrical nerve stimulator, bio-feedback.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Levine S.N. (ed), “Advances in Bio-medical engineering and Medical physics”, Vol. I, II, IV, inter university publications, New York, 1968 (Unit I, IV, V).
2. Kopff W.J, “Artificial Organs”, John Wiley and sons, New York, 1976. (Unit II).
3. Albert M.Cook and Webster J.G, “Therapeutic Medical Devices”, Prentice Hall Inc., New Jersey, 1982 (Unit III).

EC2354 VLSI DESIGN L T P C
3 0 0 3

AIM

To introduce the technology, design concepts and testing of Very Large Scale Integrated Circuits.

OBJECTIVES

- To learn the basic CMOS circuits.
- To learn the CMOS process technology.
- To learn techniques of chip design using programmable devices.
- To learn the concepts of designing VLSI subsystems.
- To learn the concepts of modeling a digital system using Hardware Description Language.

UNIT I CMOS TECHNOLOGY 9

A brief History-MOS transistor, Ideal I-V characteristics, C-V characteristics, Non ideal I-V effects, DC transfer characteristics - CMOS technologies, Layout design Rules, CMOS process enhancements, Technology related CAD issues, Manufacturing issues

UNIT II CIRCUIT CHARACTERIZATION AND SIMULATION 9

Delay estimation, Logical effort and Transistor sizing, Power dissipation, Interconnect, Design margin, Reliability, Scaling- SPICE tutorial, Device models, Device characterization, Circuit characterization, Interconnect simulation

UNIT III COMBINATIONAL AND SEQUENTIAL CIRCUIT DESIGN 9

Circuit families –Low power logic design – comparison of circuit families – Sequencing static circuits, circuit design of latches and flip flops, Static sequencing element methodology- sequencing dynamic circuits – synchronizers

UNIT IV CMOS TESTING 9

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

UNIT V SPECIFICATION USING VERILOG HDL 9

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate level switch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Structural gate level description of decoder, equality detector, comparator, priority encoder, half adder, full adder, Ripple carry adder, D latch and D flip flop.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education, 2005
2. Uyemura J.P: Introduction to VLSI circuits and systems, Wiley 2002

REFERENCES:

1 D.A Pucknell & K.Eshraghian Basic VLSI Design, Third edition, PHI, 2003
2 Wayne Wolf, Modern VLSI design, Pearson Education, 2003
3 M.J.S.Smith: Application specific integrated circuits, Pearson Education, 1997
4 J.Bhasker: Verilog HDL primer, BS publication,2001
5 Ciletti Advanced Digital Design with the Verilog HDL, Prentice Hall of India, 2003

GE2025 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

UNIT I ENGINEERING ETHICS 9

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

UNIT IV RESPONSIBILITIES AND RIGHTS 9

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 9

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

TOTAL : 45 PERIODS

TEXT BOOKS :

1. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Thompson Learning, 2000.

REFERENCES :

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, 1999.
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

BM2026 MEDICAL IMAGING TECHNIQUES L T P C
3 0 0 3

AIM

- To study the image reconstruction techniques

OBJECTIVE

- To study the quality assurance test for radiography, method of recording sectional images
- To study the functioning of radioisotopic imaging equipments
- To study the MRI, image acquisition and reconstruction
- To study the 3-D image display techniques

UNIT I ULTRASOUND IN MEDICINE 9

Production of ultrasound – properties and principles of image formation, capture and display – principles of A-mode, B-mode and M-mode display – Doppler ultra sound and colour flow mapping – applications of diagnostic ultra sound.

UNIT II X-RAY COMPUTED TOMOGRAPHY 9

Priniciples of sectional imaging – scanner configuration – data acquisition system – image formation principles – conversion of x-ray data in to scan image – 2-D image reconstruction techniques –Iteration and Fourier method – types of CT scanners.

UNIT III MAGNETIC RESONANCE IMAGING 9

Priniciples of MRI pulse sequence – image acquisition and reconstruction techniques – MRI instrumentation magnetic gradient system RF coils – receiver system functional MRI – Application of MRI

UNIT IV RADIO ISOTOPIC IMAGING 9

Rectilinear scanners – linear scanners – SPECT – PET Gamma camera radio nuclides for imaging – emission computed CT

UNIT V INFRA RED IMAGING 9

Physics of thermography – imaging systems – pyroelectric vidicon camera clinical thermography – liquid crystal thermography

TEXT BOOK:

1. Steve Webb, "The physics of medical imaging", Adam Hilger, Bristol, England, Philadelphia, USA, 1988.

REFERENCES:

1. A. C. Kak, "principles of computed tomography", IEEE press, Newyork
2. G. A. Hay, "Medical Image formation perception and measurement",
3. Divyendu Sinha & Edward R.Dougherty, "Introduction to Computer Based Imaging Systems", PHI, 2003.

CS2053 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 ARTIFICIAL INTELLIGENCE 10

Introduction, Knowledge Representation – Reasoning, Issues and Acquisition: Prepositional and Predicate Calculus Rule Based knowledge Representation Symbolic Reasoning Under Uncertainity Basic knowledge Representation Issues Knowledge acquisition – Heuristic Search: Techniques for Heuristic search Heuristic Classification - State Space Search: Strategies Implementation of Graph Search Search based on Recursion Patent-directed Search Production System and 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 PERIODS

TEXT BOOKS:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.
2. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press, 2006.

REFERENCES:

1. Elaine Rich & Kevin Knight, Artificial Intelligence, Second Edition, Tata Mcgraw Hill Publishing Comp., 2006, New Delhi.
2. Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
5. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.
6. Amit Konar, "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", CRC Press, 2008.

BM2028 RAPID PROTOTYPING L T P C
3 0 0 3

UNIT I INTRODUCTION 10

Basic operation-impact of rapid prototyping and tooling on product development-benefits-applications

UNIT II RAPID PROTOTYPING PROCESSES 10

Introduction-classification-laminated object manufacturing-fused deposition modeling-stereolithography-solid ground curing-selective laser sintering-3 D printing.

UNIT III CAD PROCESSES 10

Introduction-data requirements-solid modeling-surface modeling . Geometric processing-interface formats-model prepration-slicing,support structures and machine instructions.

UNIT IV MATERIALS FOR RAPID PROTOTYPING 5

Plastics-resins-metals-ceramics-selection of materials for suitable processes- advantages-limitations.

UNIT V RAPID TOOLING PROCESSES 10

Introduction-classification-indirect rapid tooling-silicone rubber moulding-epoxy moulding-electro forming- vacuum casting- vacuum forming- rapid tools for injection moulding- direct rapid tooling processes-SLS rapid tool-shape deposition manufacturing – laser deposition lamination- rapid tooling roots.

TOTAL : 45 PERIODS

TEXT BOOK

1. Ibrahim zeid, CAD/CAM theory and practice, Tata McGraw Hill,1998

REFERENCES:

1. PAUL F.JACOBS, Rapid Prototyping and Manufacture. Fundamentals of Stereolithography, 1995
2. Rapid proto typing reports, CAD/CAM publishing, 1991
3. Rapid News, University of Warwick, UK, 1995.
4. Rapid Tools for Injection Moulding
   (www.vmreg.com/raptia/reports/CRIF.pdf)
   Applications of RP techniques for Sheet Metal Forming
   (www.raptia.org)
   Medical RP applications
   (http:// home.att.net/~rppat/museum/mus-5.htm)