



ANNA UNIVERSITY
CHENNAI - 600 025

UNIVERSITY DEPARTMENTS

REGULATIONS 2012
CURRICULA AND SYLLABI FOR
I TO VIII SEMESTERS

B.E. BIOMEDICAL ENGINEERING
(FULL TIME)

ANNA UNIVERSITY, CHENNAI-600 025

UNIVERSITY DEPARTMENTS

R – 2012

B.E. BIOMEDICAL ENGINEERING

I – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER I

| CODE No. | COURSE TITLE | L | T | P | C |
|------------------|----------------------------------|----|---|----|-----------|
| THEORY | | | | | |
| HS8151 | Technical English - I | 3 | 1 | 0 | 4 |
| MA8151 | Mathematics I | 3 | 1 | 0 | 4 |
| PH8151 | Engineering Physics | 3 | 0 | 0 | 3 |
| CY8151 | Engineering Chemistry | 3 | 0 | 0 | 3 |
| GE8151 | Computing Techniques | 3 | 0 | 0 | 3 |
| GE8152 | Engineering Graphics | 2 | 0 | 3 | 4 |
| PRACTICAL | | | | | |
| PH8161 | Physics Laboratory | 0 | 0 | 2 | 1 |
| CY8161 | Chemistry Laboratory | 0 | 0 | 2 | 1 |
| GE8161 | Computer Practices Laboratory | 0 | 0 | 3 | 2 |
| GE8162 | Engineering Practices Laboratory | 0 | 0 | 3 | 2 |
| | TOTAL | 17 | 2 | 13 | 27 |

SEMESTER II

| CODE No. | COURSE TITLE | L | T | P | C |
|---------------|------------------------|---|---|---|---|
| THEORY | | | | | |
| HS8251 | Technical English – II | 3 | 1 | 0 | 4 |
| MA8251 | Mathematics II | 3 | 1 | 0 | 4 |
| BM8201 | Anatomy & Physiology | 3 | 0 | 0 | 3 |

| | | | | | |
|------------------|--|-----------|----------|----------|-----------|
| BM8202 | Electron Devices and Circuits | 3 | 1 | 0 | 4 |
| BM8203 | Medical Physics | 3 | 0 | 0 | 3 |
| EC8251 | Circuit Theory | 3 | 1 | 0 | 4 |
| PRACTICAL | | | | | |
| BM8211 | Circuit Analysis Laboratory | 0 | 0 | 3 | 2 |
| BM8212 | Electron Devices and Circuits Laboratory | 0 | 0 | 3 | 2 |
| | TOTAL | 18 | 4 | 6 | 26 |

SEMESTER III

| CODE No. | COURSE TITLE | L | T | P | C |
|------------------|--|-----------|----------|----------|-----------|
| THEORY | | | | | |
| MA8357 | Transform Techniques and Partial Differential Equation | 3 | 1 | 0 | 4 |
| GE8351 | Environmental Science and Engineering | 3 | 0 | 0 | 3 |
| BM8301 | Fundamentals of Biochemistry | 3 | 0 | 0 | 3 |
| BM8302 | Sensors and Measurements | 3 | 0 | 0 | 3 |
| EC8353 | Signals and Systems | 3 | 0 | 0 | 3 |
| EE8351 | Basics of Electrical Engineering | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | |
| BM8311 | Biochemistry and Human Physiology Laboratory | 0 | 0 | 3 | 2 |
| BM8312 | Sensors and Measurements Laboratory | 0 | 0 | 3 | 2 |
| | TOTAL | 18 | 1 | 6 | 23 |

SEMESTER IV

| CODE No. | COURSE TITLE | L | T | P | C |
|---------------|---|---|---|---|---|
| THEORY | | | | | |
| MA8355 | Probability and Random Processes | 3 | 1 | 0 | 4 |
| BM8401 | Biomedical Instrumentation and Measurements | 3 | 0 | 0 | 3 |
| BM8402 | Pathology and Microbiology | 3 | 0 | 0 | 3 |
| EC8351 | Digital Electronics and System Design | 3 | 0 | 0 | 3 |
| EC8452 | Operational Amplifiers and Analog Integrated Circuits | 3 | 0 | 0 | 3 |

| PRACTICAL | | | | | |
|------------------|--|-----------|----------|----------|-----------|
| BM8411 | Bio Medical Instrumentation Laboratory | 0 | 0 | 3 | 2 |
| BM8412 | Integrated Circuits Laboratory | 0 | 0 | 3 | 2 |
| BM8413 | Pathology and Microbiology Laboratory | 0 | 0 | 3 | 2 |
| TOTAL | | 15 | 1 | 9 | 22 |

SEMESTER V

| CODE No. | COURSE TITLE | L | T | P | C |
|------------------|---|-----------|----------|----------|-----------|
| THEORY | | | | | |
| BM8501 | Analog and Digital Communication | 3 | 0 | 0 | 3 |
| BM8502 | Control System for Bio Medical Engineering | 3 | 1 | 0 | 4 |
| BM8503 | Diagnostic and Therapeutic Equipment I | 3 | 0 | 0 | 3 |
| EC8503 | Microprocessor and Micro controllers | 3 | 0 | 0 | 3 |
| EC8551 | Discrete Time Signal Processing | 3 | 1 | 0 | 4 |
| E1 | Elective –I | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | |
| HS8561 | Employability Skills | 0 | 0 | 2 | 1 |
| EC8511 | Micro controller and Interfacing Laboratory | 0 | 0 | 3 | 2 |
| EC8561 | Digital Signal Processing Laboratory | 0 | 0 | 3 | 2 |
| TOTAL | | 18 | 2 | 8 | 25 |

SEMESTER VI

| CODE No. | COURSE TITLE | L | T | P | C |
|-----------------|---|----------|----------|----------|----------|
| THEORY | | | | | |
| BM8601 | Bio Mechanics | 3 | 0 | 0 | 3 |
| BM8602 | Diagnostic and Therapeutic Equipment II | 3 | 0 | 0 | 3 |
| BM8603 | Hospital Management | 3 | 0 | 0 | 3 |
| BM8604 | Radiological Equipment | 3 | 0 | 0 | 3 |
| E2 | Elective –II | 3 | 0 | 0 | 3 |
| E3 | Elective –III | 3 | 0 | 0 | 3 |

| PRACTICAL | | | | | |
|------------------|---|-----------|----------|----------|-----------|
| BM8611 | Diagnostic & Therapeutic Equipment Laboratory | 0 | 0 | 3 | 2 |
| BM8612 | Medical Electronics System Design Laboratory | 0 | 0 | 3 | 2 |
| | TOTAL | 18 | 0 | 6 | 22 |

SEMESTER VII

| CODE No. | COURSE TITLE | L | T | P | C |
|------------------|---|-----------|----------|----------|-----------|
| THEORY | | | | | |
| BM8701 | Medical Informatics | 3 | 0 | 0 | 3 |
| BM8702 | Pattern Recognition and Neural Networks | 3 | 0 | 0 | 3 |
| BM8751 | Principles of Digital Image Processing | 3 | 0 | 0 | 3 |
| E4 | Elective IV | 3 | 0 | 0 | 3 |
| E5 | Elective V | 3 | 0 | 0 | 3 |
| E6 | Elective VI | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | |
| BM8711 | Hospital Training | 0 | 0 | 4 | 2 |
| BM8712 | Medical Image Processing Lab | 0 | 0 | 3 | 2 |
| | TOTAL | 18 | 0 | 7 | 22 |

SEMESTER VIII

| CODE No. | COURSE TITLE | L | T | P | C |
|------------------|---------------------|----------|----------|-----------|-----------|
| E7 | Elective VII | 3 | 0 | 0 | 3 |
| E8 | Elective VIII | 3 | 0 | 0 | 3 |
| PRACTICAL | | | | | |
| BM8811 | Project Work | 0 | 0 | 12 | 6 |
| | TOTAL | 6 | 0 | 12 | 12 |

TOTAL NO OF CREDITS: 179

ELECTIVES

| CODE No. | COURSE TITLE | L | T | P | C |
|----------|--|---|---|---|---|
| BM8001 | Advanced Bio analytical and Therapeutic Techniques | 3 | 0 | 0 | 3 |
| BM8002 | Advanced Microprocessors | 3 | 0 | 0 | 3 |
| BM8003 | Bio Materials and Artificial Organs | 3 | 0 | 0 | 3 |
| BM8004 | Bio MEMS | 3 | 0 | 0 | 3 |
| BM8005 | Bio Signal Processing | 3 | 0 | 0 | 3 |
| BM8006 | Biomaterials and Characterization | 3 | 0 | 0 | 3 |
| BM8007 | Biometric Systems | 3 | 0 | 0 | 3 |
| BM8008 | Brain Computer Interface and Applications | 3 | 0 | 0 | 3 |
| BM8009 | Computer Hardware and Interfacing | 3 | 0 | 0 | 3 |
| EC8011 | Embedded and Real - Time Systems | 3 | 0 | 0 | 3 |
| BM8011 | Medical Optics | 3 | 0 | 0 | 3 |
| BM8012 | Neural Engineering | 3 | 0 | 0 | 3 |
| BM8013 | Physiological Modeling | 3 | 0 | 0 | 3 |
| BM8014 | Principles of Tissue Engineering | 3 | 0 | 0 | 3 |
| BM8015 | Rehabilitation Engineering | 3 | 0 | 0 | 3 |
| GE8751 | Engineering Ethics and Human Values | 3 | 0 | 0 | 3 |
| MG8654 | Total Quality Management | 3 | 0 | 0 | 3 |
| CS8251 | Data Structures and Object Oriented Programming in C++ | 3 | 0 | 0 | 3 |
| EC8071 | Cryptography and Network Security | 3 | 0 | 0 | 3 |
| EC8072 | Electro Magnetic Interference and Compatibility | 3 | 0 | 0 | 3 |
| EC8073 | Foundations of Nano- Electronics | 3 | 0 | 0 | 3 |
| EC8074 | Multimedia Compression and Communication | 3 | 0 | 0 | 3 |
| EC8075 | Robotics | 3 | 0 | 0 | 3 |
| EC8076 | Soft Computing and Applications | 3 | 0 | 0 | 3 |
| EC8451 | Computer Architecture and Organization | 3 | 0 | 0 | 3 |
| EC8651 | Digital VLSI | 3 | 0 | 0 | 3 |

OBJECTIVES

- To enable all students of engineering and technology develop their basic communication skills in English.
- To give special emphasis to the development of speaking skills amongst the students of engineering and technology students.
- To ensure that students use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading for pleasure.

UNIT I

Listening - Introducing learners to GIE - Types of listening - Listening to audio (verbal & sounds); **Speaking** - Speaking about one's place, important festivals etc. – Introducing oneself, one's family / friend; **Reading** - Skimming a reading passage – Scanning for specific information - Note-making; **Writing** - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) - Sentence completion - Autobiographical writing (writing about one's leisure time activities, hometown, etc.); **Grammar** - Prepositions - Reference words - Wh-questions - Tenses (Simple); **Vocabulary** - Word formation - Word expansion (root words / etymology); **E-materials** - Interactive exercises for Grammar & Vocabulary - Reading comprehension exercises - Listening to audio files and answering questions.

UNIT II

Listening - Listening and responding to video lectures / talks; **Speaking** - Describing a simple process (filling a form, etc.) - Asking & answering questions - Telephone skills – Telephone etiquette; **Reading** – Critical reading - Finding key information in a given text - Sifting facts from opinions; **Writing** - Biographical writing (place, people) - Lab descriptions (general/specific description of laboratory experiments) - Definitions - Recommendations; **Grammar** - Use of imperatives - Subject-verb agreement; **Vocabulary** - Compound words - Word Association; **E-materials** - Interactive exercises for Grammar and Vocabulary - Listening exercises with sample telephone conversations / lectures – Picture-based activities.

UNIT III

Listening - Listening to specific task - focused audio tracks; **Speaking** - Role-play – Simulation - Group interaction - Speaking in formal situations (teachers, officials, foreigners); **Reading**

- Reading and interpreting visual material; **Writing** - Jumbled sentences - Coherence and cohesion in writing - Channel conversion (flowchart into process) - Types of paragraph (cause & effect / compare & contrast / narrative / analytical) - Informal writing (letter/e-mail/blogs) - Paraphrasing; **Grammar** - Tenses (Past) - Use of sequence words - Adjectives; **Vocabulary** - Different forms and uses of words, Cause and effect words; **E-materials** - Interactive exercises for Grammar and Vocabulary - Excerpts from films related to the theme and follow up exercises - Pictures of flow charts and tables for interpretations.

UNIT IV

Listening - Watching videos / documentaries and responding to questions based on them; **Speaking** - Responding to questions - Different forms of interviews - Speaking at different types of interviews; **Reading** - Making inference from the reading passage - Predicting the content of a reading passage; **Writing** - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; **Grammar** - Adverbs – Tenses – future time reference; **Vocabulary** - Single word substitutes - Use of abbreviations & acronyms; **E-materials** - Interactive exercises for Grammar and Vocabulary - Sample interviews - film scenes - dialogue writing.

UNIT V

Listening - Listening to different accents, Listening to Speeches / Presentations, Listening to broadcast & telecast from Radio & TV; **Speaking** - Giving impromptu talks, Making presentations on given topics; **Reading** - Email communication - Reading the attachment files having a poem/joke/proverb - Sending their responses through email **Writing** - Creative writing, Poster making; **Grammar** - Direct and indirect speech; **Vocabulary** - Lexical items (fixed / semi fixed expressions); **E-materials** - Interactive exercises for Grammar & Vocabulary - Sending emails with attachment – Audio / video excerpts of different accents, - Interpreting posters

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Orient Black Swan, 2012.
2. S.P. Dhanavel, English and Communication Skills for students of Science and Engineering. Oriented Black Swan, Chennai, 2011

REFERENCE BOOKS:

1. Pickett, Nell Ann, Ann A.Laster and Katherine E.Staples. **Technical English: Writing, Reading and Speaking**. New York: Longman, 2001.

2. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge, 2011.
3. Morgan, David and Nicholas Regan. **Take-Off: Technical English for Engineering**. Reading: Garnet Publishing Limited, 2008.
4. Thorn, Michael and Alan Badrick. **An Introduction to Technical English**. Harlow: Prentice Hall Europe, 1993.
5. Rizvi, M.Ashraf. **Effective Technical Communication**. New Delhi: Tata McGraw-Hill Publishing Company, 2007.

EXTENSIVE READERS:

1. Murthy, Sudha. **Wise & Otherwise**. New Delhi: Penguin Books India, 2006.
2. Gates, Bill and Collins Hemingway. **Business @ the Speed of Thought: Succeeding in the Digital Economy**. New York: Warner Business Books, 2000.

WEBSITE RESOURCES:

- www.uefap.com
- www.eslcafe.com
- www.listen-to-english.com
- www.owl.english.purdue.edu
- www.chompchomp.com

MA8151

MATHEMATICS – I

L T P C

(Common to all branches of B.E. / B.Tech. Programmes in I Semester) 3 1 0 4

OBJECTIVES:

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To make the student knowledgeable in the area of infinite series and their convergence so that he/ she will be familiar with limitations of using infinite series approximations for solutions arising in mathematical modeling.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To introduce the concepts of improper integrals, Gamma, Beta and Error functions which are needed in engineering applications.

- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES

9+3

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II INFINITE SERIES

9+3

Sequences – Convergence of series – General properties – Series of positive terms – Tests of convergence (Comparison test, Integral test, Comparison of ratios and D’Alembert’s ratio test) – Alternating series – Series of positive and negative terms – Absolute and conditional convergence – Power Series – Convergence of exponential, logarithmic and Binomial Series.

UNIT III FUNCTIONS OF SEVERAL VARIABLES

9+3

Limits and Continuity – Partial derivatives – Homogeneous functions and Euler’s theorem – Total derivative – Differentiation of implicit functions – Change of variables –Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

UNIT IV IMPROPER INTEGRALS

9+3

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involving a parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions – Error functions.

UNIT V MULTIPLE INTEGRALS

9+3

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of variables in double and triple integrals – Area of a curved surface.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.

REFERENCES:

1. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
2. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
3. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
4. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH8151**ENGINEERING PHYSICS****L T P C****(Common to ALL Branches of B.E./B.Tech. Programmes) 3 0 0 3****OBJECTIVE:**

To introduce the basic physics concepts relevant to different branches of Engineering and Technology.

UNIT I PROPERTIES OF MATTER**9**

Elasticity - Poisson's ratio and relationship between moduli (qualitative) - Stress-strain diagram - factors affecting elasticity - bending of beams - cantilever - bending moment - theory and experiment of Young's modulus determination - Uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS**9**

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - rate of growth and decay of sound intensity - derivation of Sabine's formula - absorption coefficient and its determination - factors

affecting acoustics of buildings : focussing, interference, echo, Echelon effect, resonance - noise and their remedies. Ultrasonics - production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating - industrial applications - NDT - Ultrasonic method: scan modes and practice.

UNIT III THERMAL PHYSICS

9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity - conduction in solids - Forbe's and Lees' disc methods - Rectilinear flow of heat through a rod - flow of heat through a compound materials - radial flow of heat through a spherical shell - thermal insulation of buildings – Laws of blackbody radiation: Kirchoffs law, Stephens law, Wiens law, Raleigh-Jean law and Planks law (derivation). Laws of thermodynamics - Otto and diesel engines and their efficiency - entropy - entropy of Carnot's cycle - reverse Carnot's cycle - refrigerator.

UNIT IV APPLIED OPTICS

9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its application - Lasers - Einstein's coefficients - CO₂, Nd:YAG and semiconductor lasers - homo junction and hetro junction - construction and working - applications - Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V SOLID STATE PHYSICS

9

Nature of bonding - growth of single crystals (qualitative) - crystal systems - crystal planes and directions - expressions for interplanar distance - coordination number and packing factor for simple structures: SC, BCC, FCC and HCP - structure and significance of NaCl, ZnS, diamond and graphite - crystal imperfections: point defects, dislocations and stacking faults - unit cell, Bravais space lattices - miller indices.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Gaur R.K., and Gupta, S.L., Engineering Physics, Dhanpat Raj Publications, 2003
2. Palanisamy, P.K., Engineering Physics, Scitech Publications (P) Ltd, 2006.
3. Arumugam, M., Engineering Physics, Anuradha Publications, 2000.

Fluorescence, Phosphorescence, Chemiluminescence and Photo-sensitisation. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. Width and intensities of spectral lines. Spectrophotometric estimation of iron. UV-visible and IR spectroscopy – principles, instrumentation (Block diagram) and applications.

UNIT V NANO CHEMISTRY

9

Basics - distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Nanoparticles: Nanocluster, nanorod, nanotube and nanowire. Synthesis: Precipitation, thermolysis, hydrothermal, solvothermal, electrodeposition, chemical vapour deposition, laser ablation; Properties and Applications. Risk discussion and Future perspectives.

TEXT BOOKS:

1. P. Kannan and A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2009.
2. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India, 2011

REFERENCE BOOKS:

1. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 8th Ed., (Indian Student Edition) (2009).
2. K. K. Rohatgi-Mukherjee, "Fundamental of Photochemistry" New Age International (P) Ltd., New Delhi, 1986.
3. G.A. Ozin and A.C. Arsenault, "Nanotechnology: A Chemical Approach to Nanomaterials", RSC Publishing, 2005.
4. V.R. Gowariker, N.V. Viswanathan and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.), Chennai, 2006

GE8151

COMPUTING TECHNIQUES

L T P C

3 0 0 3

UNIT I INTRODUCTION

8

Generation and Classification of Computers- Basic Organization of a Computer –Number System – Binary – Decimal – Conversion – Problems. Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS

10

Problem formulation – Problem Solving - Introduction to ‘ C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

UNIT III ARRAYS AND STRINGS

9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String-String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

UNIT IV FUNCTIONS AND POINTERS

9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

UNIT V STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.

TOTAL :45 PERIODS

TEXTBOOKS:

1. Pradip Dey, Manas Ghosh, “Fundamentals of Computing and Programming in C”, First Edition, Oxford University Press, 2009
2. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
3. Yashavant P. Kanetkar. “ Let Us C”, BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
2. Byron S Gottfried, “ Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007

OBJECTIVE

To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION)**1**

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREE HAND SKETCHING**14****Basic Geometrical constructions, Curves used in engineering practices**

Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves, **Scales:** Construction of Diagonal and Vernier scales.

Visualization concepts and Free Hand sketching

Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES**14**

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS**14**

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES

14

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

15

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY)

3

Introduction to drafting packages and demonstration of their use.

TOTAL: 75 PERIODS

TEXT BOOK:

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010

REFERENCES:

1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) Subhas Stores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,” Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production”, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited ,2008.
5. K. V.Natrajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2009.
6. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi,2008.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO UNIVERSITY EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

PH8161

PHYSICS LABORATORY

L T P C

(common to all branches of B.E./B.Tech. Programmes)

0 0 2 1

- | | | |
|--------------------------|---|---|
| 1. Torsional pendulum | – | Determination of rigidity modulus of wire and moment of inertia of disc |
| 2. Non – uniform bending | – | Determination of young's modulus |
| 3. Lee's disc | – | Determination of thermal conductivity of a bad conductor |
| 4. Potentiometer | – | Determination of thermo e.m.f. of thermocouple |
| 5. Air wedge | – | Determination of thickness of a thin sheet of paper |
| 6. i. Optical fibre | – | Determination of Numerical Aperture and acceptance angle |
| ii. Compact disc | – | Determination of width of the groove using laser |
| 7. Acoustic grating | – | Determination of velocity of ultrasonic waves in liquids |
| 8. Post office box | – | Determination of Band gap of a semiconductor |
| 9. Spectrometer | – | Determination of wavelength using grating |
| 10. Viscosity of liquids | – | Determination of co-efficient of viscosity of a liquid by Poiseuille's flow |

TOTAL : 30 PERIODS

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1,10-phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics – ester hydrolysis.
13. Corrosion experiment – weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. A text of quantitative inorganic analysis, A. L. Vogel , ELBS London. 1995.
2. Experiments in physical chemistry, D.P. Shoemaker and C.W. Gardad, McGraw Hill, London, 2001.
3. American Public Health Association.

LIST OF EXPERIMENTS:

1. Search, generate, manipulate data using MS office/ Open Office
2. Presentation and Visualization – graphs, charts, 2D, 3D

3. Problem formulation, Problem Solving and Flowcharts
4. C Programming using Simple statements and expressions
5. Scientific problem solving using decision making and looping.
6. Simple programming for one dimensional and two dimensional arrays.
7. Solving problems using String functions
8. Programs with user defined functions
9. Program using Recursive Function and conversion from given program to flow chart.
10. Program using structures and unions.

TOTAL : 45 PERIODS

| | | |
|----------------|--|----------------|
| GE 8162 | ENGINEERING PRACTICES LABORATORY | L T P C |
| | (Common to all Branches of B.E. / B.Tech. Programmes) | 0 0 3 2 |

OBJECTIVE:

To provide exposure to the students with hands-on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

| | | |
|-----------|-----------------------------------|-----------|
| 1. | CIVIL ENGINEERING PRACTICE | 12 |
|-----------|-----------------------------------|-----------|

PLUMBING

- Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump – inlet.
- Laying pipe connection to the delivery side of a pump – out let.
- Practice in mixed pipe connections: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK

- Sawing, planning and making common joints: T-Joint, Mortise and Tennon joint, Dovetail joint.

STUDY

- Study of joints in door panels, wooden furniture
- Study of common industrial trusses using models.

2. ELECTRICAL ENGINEERING PRACTICE 9

- Basic household wiring using switches, fuse, indicator – lamp etc.,
- Preparation of wiring diagrams
- Stair case light wiring
- Tube – light wiring
- Study of iron-box, fan with regulator, emergency lamp

GROUP – B (MECHANICAL AND ELECTRONICS) 15

3. MECHANICAL ENGINEERING PRACTICE

WELDING

- Arc welding of butt joints, lap joints, tee joints
- Gas welding Practice.
- Basic Machining
- Simple turning, drilling and tapping operations.
- Machine assembly Practice.
- Study and assembling the following:
- Centrifugal pump, mixies and air conditioners.
- Demonstration on
 - (a) Smithy operations like the production of hexagonal bolt.
 - (b) Foundry operation like mould preparation for grooved pulley.

4. ELECTRONIC ENGINEERING PRACTICE 9

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and testing.
- Study of Telephone, FM radio, low-voltage power supplies.

TOTAL: 45 PERIODS

OBJECTIVES

- To make the students acquire listening and speaking skills meant for both formal and informal contexts
- To help them develop their reading skills by exposing them to different types of reading strategies
- To equip them with writing skills needed for academic as well as workplace situations
- To make them acquire language skills at their own pace by using e-materials and language lab component

UNIT I

Listening - Listening to informal conversations and participating; **Speaking** - Opening a conversation (greetings, comments on something, weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks); **Reading** - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; **Writing** - Effective use of SMS for sending short notes and messages - Using 'emoticons' as symbols in email messages; **Grammar** - Regular & irregular verbs - Active and passive voice; **Vocabulary** - Homonyms (e.g. 'can') - Homophones (e.g. 'some', 'sum'); **E-materials** - Interactive exercise on Grammar and vocabulary – blogging; **Language Lab** - Listening to different types of conversation and answering questions.

UNIT II

Listening - Listening to situation based dialogues; **Speaking** - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read); **Reading** - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; **Writing** - Writing a review / summary of a story / article, Personal letter (Inviting your friend to a function, congratulating someone for his success, thanking one's friend / relatives); **Grammar** - modal verbs, Purpose expressions; **Vocabulary** - Phrasal verbs and their meanings, Using phrasal verbs in sentences; **E-materials** - Interactive exercise on Grammar and vocabulary, Extensive reading activity (reading stories / novels from links), Posting reviews in blogs - **Language Lab** - Dialogues (Fill up exercises), Recording students' dialogues.

UNIT III

Listening - Listening to the conversation - Understanding the structure of conversations; **Speaking** - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret etc.); **Reading** - Speed reading – reading passages with the time limit - Skimming; **Writing** - Minutes of meeting – format and practice in the preparation of minutes - Writing summary after reading the articles from the journals - Format for the journal articles – elements of technical articles (abstract, introduction, methodology, results, discussion, conclusion, appendices, references) - Writing strategies; **Grammar** - Conditional clauses - Cause and effect expressions; **Vocabulary** - Words used as nouns and verbs without any change in the spelling (e.g. 'rock', 'train', 'ring'); **E-materials** - Interactive exercise on Grammar & vocabulary - Speed Reading practice exercises; **Language Lab** - Intonation practice using EFLU materials – Attending a meeting and writing minutes.

UNIT IV

Listening - Listening to a telephone conversation, Viewing a model interview (face-to-face, telephonic and video conferencing) and observing the practices; **Speaking** - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping the interview skills; **Reading** - Reading the job advertisements and the profile of the company concerned – scanning; **Writing** - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; **Grammar** - Numerical expressions - Connectives (discourse markers); **Vocabulary** - Idioms and their meanings – using idioms in sentences; **E-materials** - Interactive exercises on Grammar & Vocabulary - Different forms of résumés- Filling up a résumé / cover letter; **Language Lab** - Telephonic interview – recording the responses - e-résumé writing.

UNIT V

Listening - Viewing a model group discussion and reviewing the performance of each participant - Identifying the characteristics of a good listener; **Speaking** - Group discussion skills – initiating the discussion – exchanging suggestions and proposals – expressing dissent/ agreement – assertiveness in expressing opinions – mind mapping technique; **Reading** - Note making skills – making notes from books, or any form of written materials - Intensive reading **Writing** - Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation); **Grammar** - Use of clauses; **Vocabulary** – Collocation; **E-materials** - Interactive grammar and vocabulary exercises - Sample GD - Pictures for discussion, Interactive grammar and vocabulary exercises - Pictures for discussion; **Language Lab** - Different models of group discussion

TOTAL :60 PERIODS

TEXT BOOKS:

1. Mindscapes: English for Technologists and Engineers, Department of English, Anna University, Chennai, 2012 .
2. S.P. Dhanavel, English and Communication Skills for students of Science and Engineering. Oriented Black Swan, Chennai, 2011

REFERENCES:

1. Laws, Anne. **Presentations**. Hyderabad: Orient BlackSwan, 2000.
2. Lewis, Hedwig. **Body Language: A Guide for Professionals**. New Delhi: Sage Publications, 1998.
3. Naterop, Jean B. and Rod Revell. **Telephoning in English**. Cambridge: Cambridge University Press, 1987.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Ur, Penny. **Teaching Listening Comprehension**. Cambridge: Cambridge University Press, 1984.

EXTENSIVE READERS:

1. Abdul Kalam, A P J. **Ignited Minds: Unleashing the Power within India**. New Delhi: Penguin Books India, 2002.
2. Parameswaran, Uma. **C.V.Raman: A Biography**. New Delhi: Penguin Books India, 2011.

WEB RESOURCES

- www.esl-lab.com
- www.englishgrammar.org
- www.englishclub.com
- www.mindtools.com
- www.esl.about.com

MA8251

MATHEMATICS II

L T P C

(Common to all branches of B.E. / B.Tech. Programmes in II Semester) 3 1 0 4

OBJECTIVES:

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.

- To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated.

UNIT I DIFFERENTIAL EQUATIONS 9+3

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler’s and Legendre’s type – System of simultaneous linear differential equations with constant coefficients.

UNIT II VECTOR CALCULUS 9+3

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral and volume integral - Green’s, Gauss divergence and Stoke’s theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 9+3

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w= z+ c, az, 1/z, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9+3

Line integral - Cauchy’s integral theorem – Cauchy’s integral formula – Taylor’s and Laurent’s series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis

UNIT V LAPLACE TRANSFORMS 9+3

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems – Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

BM8201**ANATOMY AND PHYSIOLOGY****L T P C
3 0 0 3****OBJECTIVE:**

- Basic structural and functional elements of human body
- Organs and structures involving in system formation and functions
- All systems in the human body

UNIT I BASIC ELEMENTS OF HUMAN BODY**8**

Cell: Structure and organelles - Functions of each component in the cell. Cell membrane – transport across membrane – origin of cell membrane potential – Action potential. **Tissue:** Types – Specialized tissues – functions.

UNIT II SKELETAL AND RESPIRATORY SYSTEM**9**

Skeletal system: Bone types and functions – Joint - Types of Joint - Cartilage and functions. Respiratory System: Components of respiratory system – Respiratory Mechanism. Types of respiration - Oxygen and carbon dioxide transport and acid base regulation.

UNIT III CIRCULATORY SYSTEM**10**

Blood composition - functions of blood – functions of RBC. WBC types and their functions. Blood groups – importance of blood groups – identification of blood groups. Blood vessels - Structure of heart – Properties of Cardiac muscle – Conducting system of heart - Cardiac cycle – ECG - Heart sound - Volume and pressure changes and regulation of heart rate – Coronary Circulation. Factors regulating Blood flow.

UNIT IV URINARY AND SPECIAL SENSORY SYSTEM**9**

Urinary system: Structure of Kidney and Nephron. Mechanism of Urine formation and acid base regulation – Urinary reflex – Homeostasis and blood pressure regulation by urinary system. Special senses: Eye and Ear.

UNIT V NERVOUS SYSTEM**9**

Structure of a Neuron – Types of Neuron. Synapses and types. Conduction of action potential in neuron. Brain – Divisions of brain lobes - Cortical localizations and functions - EEG. Spinal cord – Tracts of spinal cord - Reflex mechanism – Types of reflex. Autonomic nervous system and its functions.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Elaine.N. Marieb , “ Essential of human Anatomy and Physiology”, Eight edition, Pearson Education New Delhi ,2007.
2. Gillian Pocock, Christopher D. Richards, The human Body – An introduction for Biomedical and Health Sciences, Oxford University Press, USA, 2009

REFERENCE BOOKS:

1. Review of Medical Physiology,22nd edition,William F.Ganong Mc Graw Hill New Delhi,
2. Introduction to Human Anatomy and Physiology, Eldra Pearl Solomon. W.B. Saunders Company, Harcourt Brace Jovanovich, inc.
3. Text book of Medical Physiology, Guyton & Hall. 11th Edition, Elsevier Saunders

OBJECTIVES

- To know the structure, operation and applications of the basic electronic devices.

UNIT I PN JUNCTION DEVICES**9+3**

PN junction diode –structure, operation and V-I characteristics, diffusion and transient capacitance - Rectifiers – Half Wave and Full Wave Rectifier,– Display devices- LED, Laser diodes, Zener diode-characteristics-Zener Reverse characteristics – Zener as regulator

UNIT II TRANSISTORS**9+3**

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristor and IGBT -Structure and characteristics.

UNIT III AMPLIFIERS**9+3**

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER**9+3**

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS**9+3**

Advantages of negative feedback – voltage / current, series , Shunt feedback –positive feedback – Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

L :45 T: 15 TOTAL: 60 PERIODS**TEXT BOOKS:**

1. David A. Bell ,”Electronic devices and circuits”, Prentice Hall of India, 2004.
2. Sedra and smith, “Microelectronic circuits “ Oxford University Press, 2004.

UNIT IV INTERACTION OF RADIATION WITH MATTER**9**

Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering , Pair production, Attenuation of Gamma Radiation , Interaction of neutron with matter and their clinical significance.

UNIT V BASIC RADIATION QUANTITIES**9**

Introduction -exposure- Inverse square law-KERMA-Kerma and absorbed dose -stopping power - relationship between the dosimetric quantities - Bremsstrahlung radiation, Bragg's curve- concept of LD 50- Stochastic and Non-stochastic effects, Different radiation Unit, Roentgen, gray, Sievert.

TOTAL: 45 PERIODS.**TEXT BOOKS:**

1. John R Cameran , James G Skofronick "Medical Physics" John-Wiley & Sons.1978
2. W.J.Meredith and J.B. Massey "Fundamental Physics of Radiology" Varghese Publishing house.1992

REFERENCES:

1. P.Uma Devi, A.Nagarathnam , B S SatishRao , "Intorduction to Radiation Biology" B.I ChurChill Livingstone pvt Ltd,2000
2. S.Webb " The Physics of Medical Imaging", Taylor and Francis,1988
3. J.P.Woodcock,Ultrasonic,Medical Physics Handbook series 1,Adam Hilger,Bristol,2002
4. Hylton B.Meire and Pat Farrant "Basic Ultrasound" John Wiley& Sons, 1995

EC8251**CIRCUIT THEORY****L T P C****3 1 0 4****OBJECTIVES:**

- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

UNIT I DC CIRCUIT ANALYSIS 9

Basic Components and electric Circuits, Charge, current, Voltage and Power, Voltage and Current Sources, Ohms Laws, Voltage and Current laws, Kirchoff's Current Law, Kirchoff's voltage law, The single Node – Pair Circuit, series and Parallel Connected Independent Sources, Resistors in Series and Parallel, voltage and current division, Basic Nodal and Mesh analysis, Nodal analysis, Mesh analysis.

UNIT II NETWORK THEOREM AND DUALITY 8

Useful Circuit Analysis techniques, Linearity and superposition, Thevenin and Norton Equivalent Circuits, Maximum Power Transfer, Delta-Wye Conversion. Duals, Dual circuits.

UNIT III SINUSOIDAL STEADY STATE ANALYSIS 10

Sinusoidal Steady – State analysis , Characteristics of Sinusoids, The Complex Forcing Function, The Phasor, Phasor relationship for R, L, and C, impedance and Admittance, Nodal and Mesh Analysis, Phasor Diagrams, AC Circuit Power Analysis, Instantaneous Power, Average Power, apparent Power and Power Factor, Complex Power.

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS 9

Basic RL and RC Circuits, The Source- Free RL Circuit, The Source-Free RC Circuit, The Unit-Step Function, Driven RL Circuits, Driven RC Circuits, RLC Circuits, Frequency Response, Parallel Resonance, Series Resonance, Quality Factor.

UNIT V COUPLED CIRCUITS AND TOPOLOGY 9

Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

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

TEXT BOOKS:

1. William Hayt, Jr. Jack E. Kemmerly, Steven M. Durbin, "Engineering Circuit Analysis", Sixth Edition, Tata McGraw-Hill Edition, 2006.
2. David A Bell, "Electric Circuits", PHI, 2006

REFERENCES:

1. Charles K. Alexander & Mathew N.O.Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw- Hill 2003.
2. Sudhakar. A and Shyammohan S. Palli, Tata Mc Graw –Hill, Third Edition, 2007.
3. D.R.Cunningham, J.A.Stuller, "Basic Circuit Analysis", Jaico Publishing House, 1996.
4. David E.Johnson, Johny R. Johnson, John L.Hilburn, "Electric Circuit Analysis", Second Edition, Prentice-Hall international Editions, 1997
5. K.V.V.Murthy, M.S.Kamath, "Basic Circuit Analysis", Jaico Publishing House, 1999.
6. Norman Balabanian, "Electric Circuits", International Edition, 1994.

BM8211

CIRCUIT ANALYSIS LABORATORY

L T P C
0 0 3 2

LIST OF EXPERIMENTS:

1. Verification of ohm's law.
2. Verification of kirchoff's laws.
3. Verification of thevenin's theorem.
4. Verification of reciprocity theorem.
5. Verification of superposition theorem.
6. Verification of maximum power transfer theorem.
7. Frequency Response of series resonance circuit.
8. Frequency Response of parallel resonance circuit.
9. Transient analysis of RL and RC circuits.
10. Frequency Response of single tuned coupled circuits.

TOTAL:45 PERIODS

LABORATORY REQUIREMENTS

| | |
|--|-------------------------|
| Resistors, Capacitors, Inductors | – sufficient quantities |
| Bread Boards | – 15 Nos |
| CRO (30MHz) | – 10 Nos. |
| Function Generators (3MHz) | – 10 Nos. |
| Dual Regulated Power Supplies (0 – 30V) | – 10 Nos. |
| Ammeter | – 10 Nos. |
| Voltmeters | – 10 Nos. |

LIST OF EXPERIMENTS:

1. PN Junction Diode Characteristics
2. Zener Diode Characteristics
3. Half Wave and Full Wave Rectifier
4. Zener Regulator
5. CE Transistor Characteristics
6. UJT Characteristics
7. FET Characteristics
8. Characteristics of Thyristor.
9. Frequency Response of CE Amplifier
10. Design and Analysis of Feedback Amplifiers
11. Design and Analysis of Differential Amplifier
12. Design of RC Oscillators
13. Design of LC Oscillators

TOTAL : 45 PERIODS**LABORATORY REQUIREMENTS**

| | |
|--|-------------------------|
| BC 107, BC 148, 2N2646, BFW10 | – 25 each |
| 1N4007, Zener diodes | – 25 each |
| Resistors, Capacitors, Inductors | – sufficient quantities |
| Bread Boards | – 15 Nos |
| CRO (30MHz) | – 10 Nos. |
| Function Generators (3MHz) | – 10 Nos. |
| Dual Regulated Power Supplies (0 – 30V) | – 10 Nos. |

OBJECTIVES:

- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes;
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems;
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic;
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS**9+3**

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange’s Linear equation – Integral surface passing through a given curve – Classification of Partial Differential Equations – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous PDE.

UNIT II FOURIER SERIES**9+3**

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval’s identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION**9+3**

Method of separation of Variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT IV FOURIER TRANSFORM**9+3**

Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms –Properties – Transform of elementary functions – Convolution theorem – Parseval’s identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS**9+3**

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

TOTAL : 60 PERIODS

TEXT BOOK:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2007.

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
2. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 11th Reprint, 2010.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.), New Delhi, 7th Edition, 2009.
4. Peter V.O'Neil, Advanced Engineering Mathematics, Cengage Learning India Pvt., Ltd, New Delhi, 2007.

GE8351 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

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

– soil 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 production 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, New Delhi, (2006).

REFERENCE 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)

BM8301**FUNDAMENTALS OF BIOCHEMISTRY****L T P C
3 0 0 3****OBJECTIVE:**

- To get a clear idea of biomolecules and their functions.
- To know the significance of biomolecules in biological systems.
- To understand the metabolic pathways in normal and pathological conditions.
- To broaden students perspectives in Biochemistry.

UNIT I INTRODUCTION TO BIOCHEMISTRY**9**

Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organism . Principle of viscosity, surface tension, adsorption, diffusion, osmosis and their applications in biological systems.

UNIT II CARBOHYDRATES**9**

Classification of carbohydrates f- mono, di, oligo and polysaccharides. Isomerism, racemisation and mutarotation .Structure, physical and chemical properties of carbohydrates. Metabolic

pathways and bioenergetics – Glycolysis, glycogenesis, glycogenolysis and its hormonal regulation. TCA cycle and electron transport chain. Oxidative phosphorylation

UNIT III LIPIDS

9

Classification of lipids- simple, compound and derived lipids. Nomenclature of fatty acid, physical and chemical properties of fat. Saponification number, Reichert- Meissl number and iodine number. Metabolic pathways: synthesis and degradation of fatty acid (beta oxidation), hormonal regulation of fatty acid metabolism, ketogenesis, structural architecture and significance of biological membrane.

UNIT IV NUCLEIC ACID & PROTEIN

9

Structure of purines and pyrimidines, nucleoside, nucleotide, DNA act as a genetic material, Chargoff's rule. Watson and Crick model of DNA. Structure of RNA and its type. Classification, structure and properties of proteins, structural organization of proteins, classification and properties of amino acids. Separation of protein: gel filtration, electrophoresis and ultracentrifugation.

UNIT V ENZYME AND ITS KINETICS

9

Classification of enzymes, apoenzyme, coenzyme, holoenzyme and cofactors. Kinetics of enzymes - Michaelis-Menten equation. Factors affecting enzymatic activity: temperature, pH, substrate concentration and enzyme concentration. Inhibitors of enzyme action: Competitive, non-competitive, irreversible. Enzyme: Mode of action, allosteric and covalent regulation. Clinical significance of enzymes. Measurement of enzyme activity and interpretation of units.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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.

OBJECTIVES:

- This course elaborates the purpose of measurement, the methods of measurements, errors associated with measurements, the principle of transduction, classifications and the characteristics of different transducers and the different display and recording devices and some biomedical applications.

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: 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, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive 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 – Concepts of filters, 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, Inkjet 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. A.K.Sawhney,“Electrical & Electronics Measurement and Instrumentation”, 10th edition,Dhanpat Rai&Co,New Delhi,2000.
2. Ernest o Doebelin and dhanesh N manik, Measuremet systems, Application and design, 5th edition ,McGraw-Hill, 2007.
3. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.
4. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 2007.
5. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 2004.

EC8353**SIGNALS AND SYSTEMS****L T P C
3 0 0 3****OBJECTIVES:**

- To introduce visualization and mathematical representation of continuous-time and discrete-time signals
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous-time signals
- To teach the applications of Z- and Fourier transforms in the analysis of discrete –time signals

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

Continuous time signals (CT signals)- Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential - classification of CT and DT signals –periodic and aperiodic signals, random signals, Energy & Power signals - CT systems and DT systems, Classification of systems.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis- Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms in Signal Analysis.

UNIT III LINEAR TIME INVARIANT –CONTINUOUS TIME SYSTEMS 9

Differential Equation-Block diagram representation-impulse response, Convolution integrals- Fourier and Laplace transforms in Analysis.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband Sampling of CT signals- Aliasing, DTFT and properties, Z-transform & properties.

UNIT V LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS 9

Difference Equations-Block diagram representation-Impulse response-Convolution sum-DTFT and Z Transform analysis of Recursive & Non-Recursive systems.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, Indian Reprint, 2007.
2. P.Ramakrishna Rao, "Signals and Systems", Tata Mc Graw Hill Publications, 2008.
3. B. P. Lathi, "Principles of Linear Systems and Signals", Oxford, Second Edition, 2009.

REFERENCES:

1. H P Hsu, " Signals and Systems", Schaum's Outlines, Tata McGraw Hill, 2006
2. Edward W. Kamen, Bonnie S. Heck, "Fundamentals of Signals and Systems Using the Web and MATLAB", Pearson, Indian Reprint, 2007
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007
4. M.J.Roberts, "Signals & Systems, Analysis using Transform methods & MATLAB", Tata McGraw Hill (India), 2007.

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 INDUCTION THEORY**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 TRANSFORMER**9**

Introduction – Single phase transformer construction and principle of operation – EMF equation of transformer-Transformer no-load phasor diagram — Transformer on-load phasor diagram — Equivalent circuit of transformer – Regulation of transformer –Transformer losses and efficiency-All day efficiency –auto transformers.

UNIT III DC MACHINES**9**

Construction of DC machines – theory of operation of DC generators – characteristics of DC generators-Applications. Operating principle of DC motors – types of DC motors and their characteristics – speed control of DC motors-Applications, Stepper motor and Applications.

UNIT IV INDUCTION MACHINES AND SYNCHRONOUS MACHINES**9**

Principle of operation of three-phase induction motors – Construction –Types – Equivalent circuit –Construction of single-phase induction motors – Types of single phase induction motors – Double revolving field theory – starting methods

Principles of alternator – Construction details – Types – Equation of induced EMF – Voltage regulation. Methods of starting of synchronous motors – Torque equation – V curves – Synchronous motors.

Single phase induction motor, principle of operation, torque-speed characteristics - Types of single phase motors- Split phase motors; Split Phase Resistance Start Induction motor, Split phase capacitor start induction motor, Permanent –split capacitor induction motor-Single phase Commutator Motors- Repulsion motor, Repulsion start Induction run motor - AC Series Motor

TOTAL: 45 PERIODS

TEXT BOOKS:

1. D P Kothari and I J Nagrath, "Basic Electrical Engineering", TMH, 2ed, 2002
2. P. C Sen, "Principles of Electric machines and power electronics", John- Wiley & Sons, 2ed, 2001

REFERENCE:

1. R.K. Rajput, "Basic Electrical & Electronics Engineering", Lakshmi Publishers Reprint 2008

BM8311 BIOCHEMISTRY AND HUMAN PHYSIOLOGY LABORATORY**LT P C****0 0 3 2****LIST OF EXPERIMENTS:**

1. General tests for carbohydrates, proteins and lipids.
2. Preparation of serum and plasma from blood.
3. Estimation of blood glucose.
4. Estimation of creatinine
5. Estimation of urea
6. Estimation of cholesterol
7. Assay of SGOT/SGPT
8. Separation of proteins by SDS electrophoresis
9. Separation of amino acids by thin layer chromatography
10. Separation of DNA by agarose gel electrophoresis
11. ESR , PCV, MCH , MCV ,MCHC , total count of RBCs and hemoglobin estimation

12. Differential count of different WBCs and blood group identification.
13. Measurement of pH of solutions using pH meter.
14. Ishihara chart for color blindness and snellen's chart for myopia and hyperopia - by letters reading and ophthalmoscope to view retina
15. Weber's and Rinne "s test for auditory conduction.

TOTAL: 45 PERIODS

LABORATORY REQUIREMENTS FOR 30 STUDENTS

| | |
|------------------------------------|-----------|
| Spectrophotometer | 1 No |
| Colorimeter | 2 Nos. |
| pH meter | 1 No |
| Weighing balance | 1 No |
| Refrigerator | 1 No |
| Vortex Shaker | 2 Nos. |
| SDS gel electrophoresis | 1 No |
| TLC, ready TLC plates | 1 No |
| Wintrobe's tube | 2 Nos. |
| Centrifuge Normal | 1 No |
| Centrifuge Cooling | 1 No |
| Microslides | 2 packets |
| Lancet | 5 boxes |
| Microscope | 1 No |
| Neubaur's Chamber | 2 Nos. |
| Heparinized Syringe | 1box |
| Haemoglobinometer | 1 No |
| Capillary tubes | 1box |
| Ophthalmoscope (direct & Indirect) | 1 No |
| Tuning fork (256Hz to 512Hz) | 5 Nos. |
| Blood grouping kit | 1 No |

LIST OF EXPERIMENTS:

1. Characteristics of strain gauges.
2. Displacement measurement using LVDT.
3. Characteristics of temperature sensors – thermistor and RTD.
4. Characteristics of thermocouple
5. Characteristics of Light sensors-LDR, PhotoDiode, Photo Transistor
6. Characteristics of Piezoelectric Transducer.
7. Wheatstone Bridge and Kelvin's Bridge for Measurement of Resistance.
8. Measurement of capacitance and inductance using bridge circuits.
9. Study of Medical Oscilloscope.
10. Study of Input / Output characteristics using X – Y oscilloscope.

TOTAL: 45 PERIODS**LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS**

| | |
|--|-------|
| Strain gauge Trainer Kit | 1 No |
| Loads for measurement | 1 set |
| LVDT trainer kit | 1 No |
| LVDT sensor | 1 No |
| Thermocouple trainer kit | 1 No |
| Thermocouple | 1 No |
| Thermistor Trainer kit | 1 No |
| Thermistor | 1 No |
| RTD Trainer Kit | 1 No |
| RTD | 1 No |
| Thermometer | 3 No |
| Heater with water bath | 3 No |
| LDR, Photo Diode, Photo Transistor trainer kit | 1 No |
| Light Source with Variable power supply | 1 No |
| Piezoelectric Trainer Kit | 1 No |

| | |
|----------------------------|--------|
| Piezoelectric transducer | 1 No |
| Vibration excitor | 1 No |
| Wheatstone Bridge | 1 No |
| Kelvin's Bridge | 1 No |
| Schering Bridge | 1 No |
| Maxwell Bridge trainer Kit | 1 No |
| Decade resistance Box | 3 nos |
| Decade Inductance Box | 3 Nos |
| Decade Capacitance Box | 3 Nos |
| Medical oscilloscope | 1 No |
| X-Y oscilloscope | 1 No |
| X-Y Recorder | 1 No |
| Voltmeter | 10 Nos |
| Multi meter | 10 Nos |
| Regulated power supply | 10 Nos |
| CRO | 10 Nos |
| Connecting wires | |
| Pathcards | |

MA8355

PROBABILITY AND RANDOM PROCESSES

L T P C
3 1 0 4

OBJECTIVES:

- To provide the necessary basic concepts in probability and random processes and apply them in random signals, linear systems etc. in communications engineering.
- The students will have an exposure of various distributions.

UNIT I RANDOM VARIABLES

9+3

Discrete and Continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III RANDOM PROCESSES 9+3

Classification – Stationary process – Markov process - Poisson process – Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9+3

Auto-correlation functions – Cross-correlation functions – Properties – Power spectral density – Cross-spectral density – Properties.

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.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Ibe, O.C. “Fundamentals of Applied Probability and Random Processes”, Elsevier, U.P., 1st Indian Reprint, 2007.
2. Peebles, P.Z., “Probability, Random Variables and Random Signal Principles”, Tata McGraw Hill, New Delhi, 4 th Edition, 2002.

REFERENCES:

1. Yates, R.D. and Goodman, D.J., “Probability and Stochastic Processes”, John Wiley and Sons, 2nd Edition, 2005.
2. Miller, S. L. and Childers, D. G., “Probability and Random Processes with Applications to Signal Processing and Communications”, Academic Press, 2004.
3. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random
4. Variables and Random Processes”, Tata McGraw Hill, New Delhi, 9th reprint,2010.

OBJECTIVES:

- To study the Bio potential measurement.
- To study the signal conditioning circuits used for Biopotential measurement.
- To study the technique used in measurement of various bio chemical, bio mechanical parameters.

UNIT I BIOPOTENTIAL 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 BIOPOTENTIAL MEASUREMENT**9**

Biosignal characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG – unipolar and bipolar mode.

UNIT III BIOPOTENTIAL 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. Power line interference.

UNIT IV BIOMECHANICAL MEASUREMENT**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 BIOCHEMICAL MEASUREMENT**9**

Biochemical sensors - pH, P_{O_2} and P_{CO_2} , Ion selective Field Effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers,

colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

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, 2006

REFERENCES:

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. Myer Kutz Standard Handbook of Biomedical Engineering & Design – McGraw-Hill Publisher, 2003.

BM8402

PATHOLOGY AND MICROBIOLOGY

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

OBJECTIVE:

- To gain a knowledge on the structural and functional aspects of living organisms.
- To know the etiology and remedy in treating the pathological diseases.
- To empower the importance of public health.

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA

9

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. Autopsy and biopsy.

UNIT II FLUID AND HEMODYNAMIC DERRANGEMENTS 9

Edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas.

UNIT III MICROSCOPES 9

Light microscope – bright field, dark field, phase contrast, fluorescence, Electron microscope (TEM& SEM). Preparation of samples for electron microscope. Staining methods – simple, gram staining and AFB staining.

UNIT IV MICROBIAL CULTURES 9

Morphological features and structural organization of bacteria, growth curve, identification of bacteria , culture media and its types , culture techniques and observation of culture.

UNIT V IMMUNOLOGY 9

Natural and artificial immunity, opsonization, phagocytosis, inflammation, Immune deficiency syndrome, antibodies and its types, antigen and antibody reactions, immunological techniques: immunodiffusion, immuno electrophoresis, RIA and ELISA, monoclonal antibodies. Disease caused by bacteria, fungi, protozoal, virus and helminthes.

TOTAL : 45 PERIODS.

TEXT BOOKS:

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

REFERENCES:

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone 3edn.2000.
2. Microbiology by Ananthanarayanan & Panicker
3. Microbiology .Dubey RC and Maheswari DK.
4. A textbook of Microbiology. by S Chand 2007.
5. Prescott, Harley,Klein.Microbiology.Mc Graw Hill 5th ed. 2002.

OBJECTIVES

- To introduce Boolean algebra and its applications in digital systems
- To introduce design of various combinational digital circuits using logic gates
- To bring out the analysis and design procedures for synchronous and asynchronous sequential circuits
- To introduce the electronic circuits involved in the making of logic gates
- To introduce semiconductor memories and related technology

UNIT I BASIC CONCEPTS AND COMBINATIONAL CIRCUITS 9

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1s and 2s complements, Codes – Binary, BCD, 84-2-1, 2421, Excess 3, Biquinary, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map and Tabulation methods, Problem formulation and design of combinational circuits, Code-Converters

UNIT II MSI CIRCUITS 9

Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder, Carry Look Ahead Adder, BCD Adder, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Mux/Demux, Implementation of combinational logic using standard ICs, ROM, EPROM and EEPROM, PLA and PAL.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FFs, Analysis and design of clocked sequential circuits Moore and Mealy Circuits and their design, state minimization, state assignment, circuit implementation, Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits

UNIT V LOGIC FAMILIES AND SEMICONDUCTOR MEMORIES**9**

Logic families- TTL, MOS, CMOS, Comparison of Logic families, Basic memory cell, RAM, Memory decoding, Static and Dynamic memories.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. Morris Mano, " Digital logic ", Pearson, 2009
2. Charles H. Roth, Jr, "Fundamentals of Logic Design", Fourth edition, Jaico Books, 2002

REFERENCES:

1. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice- Hall of India, 1980
2. Floyd T.L., "Digital Fundamentals", Charles E. Merrill publishing company, 1982
3. John. F. Wakerly, "Digital design principles and practices", Pearson Education, Fourth Edition, 2007.

EC8452 OPERATIONAL AMPLIFIERS AND ANALOG INTEGRATED CIRCUITS**L T P C
3 0 0 3****OBJECTIVES:**

- To study the circuit configuration of linear integrated circuits
- To introduce practical applications of linear integrated circuits
- To introduce the concept of analog multiplier and Phase Locked Loop with applications
- To study ADC and DAC
- To introduce special function ICs and its construction

UNIT I CIRCUIT CONFIGURATION FOR LINEAR ICS**9**

Current sources, Analysis of difference amplifiers with active loads, supply and temperature independent biasing, Band gap references, Monolithic IC operational amplifiers, specifications, frequency compensation, slew rate and methods of improving slew rate.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS**9**

Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator, Integrator Voltage to Current converter, Instrumentation

amplifier, Sine wave Oscillators, Low pass and band pass filters, comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear function generator.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analysis of four quadrant and variable Transconductance multipliers, Voltage controlled Oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators. Frequency synthesizers, Compander ICs

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Analog switches, High speed sample and hold circuits and sample and hold IC's, Types of D/A converter Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, DM and ADM, Voltage to Time and Voltage to frequency converters.

UNIT V SPECIAL FUNCTION ICs 9

Timers, Voltage regulators - linear and switched mode types, Switched capacitor filter, Frequency to Voltage converters, Tuned amplifiers, Power amplifiers and Isolation Amplifiers, Video amplifiers, Fiber optics ICs and Opto couplers, Sources for Noises, Op Amp noise analysis and Low noise OP-Amps.

TOTAL : 45 PERIODS

TEXTBOOK:

1. Sergio Franco, " Design with operational amplifiers and analog integrated circuits", McGraw Hill, 1997.

REFERENCES:

1. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 1995.
2. Michael Jacob J., " Applications and Design with Analog Integrated Circuits ", Prentice Hall of India, 1996.
3. Ramakant A. Gayakwad, " OP - AMP and Linear IC's ", Prentice Hall, 1994.
4. Botkar K.R., " Integrated Circuits ", Khanna Publishers, 1996.
5. Taub and Schilling, " Digital Integrated Electronics ", McGraw Hill, 1977.
6. Caughlier and Driscoll, " Operational amplifiers and Linear Integrated circuits ", Prentice Hall, 1989.
7. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001.

LIST OF EXPERIMENTS:

1. Design of low noise pre-amplifier for ECG.
2. Study of effect of offset potential in Bio potential recording.
3. Study of effect of contact impedance in Bio potential recording.
4. Measurement of pulse-rate using Photo transducer.
5. Measurement of respiration rate.
6. Measurement of blood flow velocity using ultrasound transducer.
7. Measurement of heart rate using F-V converter.
8. Measurement of blood pressure.
9. Analysis of bio signals using spectrum analyzer.
10. Study of characteristics of optical Isolation amplifiers.

TOTAL: 45 PERIODS.

LABORATORY REQUIREMENTS FOR A BATCH OF 30 STUDENTS

- Pulse rate measurement system using Photo transducer
- Respiration measurement system.
- Blood flow measurement system using ultrasound transducer
- Heart rate measurement system with F-V converter
- Blood pressure measurement system
- Isolation amplifier with optical isolation setup
- Spectrum Analyzer
- Function Generators
- DSOs
- Regulated Power supplies
- Bread boards
- IC 741

LIST OF EXPERIMENTS:

1. Inverting, non-inverting amplifier and comparator
2. Integrator and Differentiator
3. Active filter – first order and second 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**LAB REQUIREMENTS**

- | | | |
|----|---|--------------|
| 1. | Digital Trainer Kit (with 5 V, Variable and fixed frequency Clock, Bread Board, Four Seven Segment displays, LEDs for output display, Logic 1 and 0 Input switches) | - 15 Nos. |
| 2. | Logic ICs (7400, 7402, 7404, 7408, 7410, 7420, 7432, 7447, 7448, 7474, 7476, 7483, , 7485, 7486, 7490, 7495, 74151, 741 Common Anode and cathode 7-segment displays, LEDs) | - 50Nos each |
| 3. | Resistors | - 50 nos |
| 4. | capacitors | - 50 nos |
| 5. | IC Power supply (5 V fixed) | - 15 Nos |
| 6. | Bread Boards | - 15 Nos |

LIST OF EXPERIMENTS:

1. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
2. Study of parts of compound microscope
3. Histopathological slides of benign and malignant tumours.
4. Manual paraffin tissue processing and section cutting (demonstration)
5. Cryo processing of tissue and cryosectioning (demonstration)
6. Basic staining – Hematoxylin and eosin staining.
7. Special stains – cresyl fast Blue (CFV)- Trichrome – oil red O – PAS
8. Simple stain.
9. Gram stain.
10. AFB stain.
11. Slides of malarial parasites, micro filaria and leishmania donovani.
12. Haematology slides of anemia and leukemia. Study of bone marrow charts.
13. Bleeding time and clotting time.

TOTAL : 45 PERIODS.**LABORATORY REQUIREMENTS FOR 30 STUDENTS**

| | |
|-------------------------|------|
| Wax dispenser | 1 No |
| Slide warming | 1 No |
| Microtome | 1 No |
| Microscope | |
| Microphotographic unit- | 1No |
| Slides | 1box |
| Coverslip | 1box |
| Distillation Unit | 1 No |
| Water bath normal | 1 No |
| Incubator | 1 No |
| Autoclave | 1 No |
| Oven | 1 No |

OBJECTIVES:

- To study the various analog and digital modulation techniques
- To study the principles behind information theory and coding
- To study the various digital communication techniques

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,

TOTAL: 45 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

BM8502**CONTROL SYSTEMS FOR BIO MEDICAL ENGINEERING****L T P C****3 1 0 4****OBJECTIVE:**

- To study the concept and different mathematical techniques applied in analyzing any given system
- To learn the analysis of given system in time domain and frequency domain
- To study the stability analysis of the given system
- To study the concept of physiological control system

UNIT I CONTROL SYSTEM MODELING**9+3**

Terminology and basic structure of control system, example of a closed loop system, transfer functions, modeling of electrical systems, translational and rotational mechanical systems, and 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 TIME RESPONSE ANALYSIS**9+3**

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 computations.

UNIT III STABILITY ANALYSIS**9+3**

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 IV FREQUENCY RESPONSE ANALYSIS**9+3**

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 response frequency and bandwidth.

UNIT V PHYSIOLOGICAL CONTROL SYSTEM**9+3**

Example of physiological control system, difference between engineering and physiological control systems, generalized system properties, models with combination of system elements, linear models of physiological systems-Examples, introduction to simulation.

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.

BM8503**DIAGNOSTIC AND THERAPEUTIC EQUIPMENT-I****L T P C****3 0 0 3****OBJECTIVE:**

- To study about the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them

- To know about some of the cardiac assist devices
- To gain information about the measurement of signals generated by muscles
- To study about the need and use of some of extracorporeal devices

UNIT I CARDIAC EQUIPMENT 9

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

UNIT II NEUROLOGICAL EQUIPMENT 9

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

UNIT III SKELETAL MUSCULAR EQUIPMENT 9

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

UNIT IV PATIENT MONITORING AND BIOTELEMETRY 9

Patient monitoring systems, 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 V EXTRA CORPOREAL DEVICES AND SPECIAL DIAGNOSTIC TECHNIQUES 9

Need for heart lung machine, functioning of bubble, disc type and membrane type oxygenators, finger pump, roller pump, electronic monitoring of functional parameter. Hemo Dialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy. Thermography – Recording and clinical application, ophthalmic instruments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Joseph J. Carr and John M. Brown, "Introduction to Biomedical equipment technology", Pearson education, 2004.

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**

8051 – Architecture, Special Function Registers(SFRs), I/o Pins Ports and Circuits, Instruction set, Addressing modes, Assembly language programming,

UNIT V INTERFACING 8051: MEMORY, I/O, INTERRUPTS**9**

Programming 8051 Timers- Serial Port Programming- Interrupts Programming LCD & Keyboard Interfacing- ADC, DAC & Sensor Interfacing, External Memory Interface- RTC Interfacing using I2C Standard- Motor Control- Relay, PWM, DC & Stepper Motor.

TOTAL : 45 PERIODS**TEXTBOOKS:**

1. Ramesh S. Gaonkar, Microprocessor Architecture Programming and Applications with 8085. Fifth edition, Penram International Publishing 2010.
2. Douglas V.Hall, Microprocessor and Interfacing, Programming and Hardware. Revised second Edition 2006, Eleventh Reprint 2010. Tata McGraw Hill
3. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D.MCKinlay The 8051 Microcontroller and Embedded Systems, Second Edition 2008, Fifth Impression 2010, Pearson Education 2008.

REFERENCES:

1. Krishna Kant, “ Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint 2011
2. Kenneth J.Ayala., “The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2007, New Delhi.
3. A.K. Ray , K.M .Bhurchandi “Advanced Microprocessor and Peripherals” ,Second edition, Tata McGraw-Hill, 2007.
4. Barry B.Brey, “The Intel Microprocessors Architecture, Programming and Interfacing” Pearson Education, 2007. New Delhi.
5. Nilesh B Bahadure, “ Microprocessors The 8086 to Pentium Family, PHI, 2010

TEXTBOOKS:

1. A.V.Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing, 8th Indian Reprint, Pearson, 2004.
2. John G Proakis and Manolakis, “ Digital Signal Processing Principles, Algorithms and Applications”, Pearson, Fourth Edition, 2007

REFERENCES:

1. I.C.Ifeachor and B.W. Jervis, Digital Signal Processing- A practical approach, Pearson, 2002.
2. M.H.Hayes, Digital Signal Processing, Schaum’s outlines, Tata McGraw Hill, 2007.
3. S.K. Mitra, Digital Signal Processing, A Computer Based approach, Tata McGraw-Hill, 1998.
4. D.J. De Fatta, J.G.Lucas and W.S. Hodgkiss, Digital Signal Processing- A system Design Approach, John Wiley & sons, Singapore, 1988.
5. P.P. Vaidyanathan, “Multirate Systems and Filter Banks”, Prentice Hall, Englewood cliffs, NJ, 1993.

HS8561

EMPLOYABILITY SKILLS
(Lab / Practical Course)

L T P C
0 0 2 1

(Common to all branches of Fifth or Sixth Semester B.E / B.Tech programmes)

OBJECTIVES:

- To enhance the employability skills of students with a special focus on Presentation skills, Group discussion skills and Interview skills
- To help them improve their soft skills, including report writing, necessary for the workplace situations
 1. Making presentations – introducing oneself – introducing a topic – answering questions – individual presentation practice
 2. Creating effective PPTs – presenting the visuals effectively
 3. Using appropriate body language in professional contexts – gestures, facial expressions, etc.
 4. Preparing job applications - writing covering letter and résumé

5. Applying for jobs online - email etiquette
6. Participating in group discussions – understanding group dynamics - brainstorming the topic
7. Training in soft skills - persuasive skills – People skills - questioning and clarifying skills – mock GD
8. Writing Project proposals – collecting, analyzing and interpreting data / drafting the final report
9. Attending job interviews – answering questions confidently
10. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 PERIODS

REQUIREMENTS FOR A CLASS OF 30 STUDENTS:

1. A PC or a lap top with one or two speakers
2. A Collar mike and a speaker
3. An LCD projector and a screen
4. CD's and DVD's on relevant topics

REFERENCES:

1. Dhanavel, S.P. 2010. *English and Soft Skills*. Hyderabad: Orient BlackSwan Ltd.
2. Corneilissen, Joep. *How to Prepare for Group Discussion and Interview*. New Delhi: Tata-McGraw-Hill, 2009.
3. D'Abreo, Desmond A. *Group Discussion and Team Building*. Mumbai: Better Yourself Books, 2004.
4. Ramesh, Gopalswamy, and Mahadevan Ramesh. *The ACE of Soft Skills*. New Delhi: Pearson, 2010.
5. Gulati, Sarvesh. *Corporate Soft Skills*. New Delhi: Rupa and Co. 2006.
6. Van Emden, Joan, and Lucinda Becker. *Presentation Skills for Students*. New York: Palgrave Macmillan, 2004.

EXTENSIVE READERS

1. Covey, Stephen R. *The 7 Habits of Highly Effective People*. New York: Free Press, 1989.
2. Bagchi, Subroto. *The Professional*. New Delhi: Penguin Books India, 2009.

WEB RESOURCES

1. www.humanresources.about.com
2. www.careerride.com

8085 BASED EXPERIMENTS

1. Assembly Language Programming of 8085

8086 BASED EXPERIMENTS

2. Programs for 16 bit Arithmetic, Sorting, Searching and String operations,
3. Programs for Digital clock, Interfacing ADC and DAC
4. Interfacing and Programming 8279, 8259, and 8253.
5. Serial Communication between two Microprocessor Kits using 8251.
6. 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.
7. Macroassembler Programming for 8086

8051 BASED EXPERIMENTS

8. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
9. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.
10. Interfacing – DAC and ADC and 8051 based temperature measurement
11. Interfacing – LED and LCD
12. Interfacing – stepper motor traffic light control
13. Communication between 8051 Microcontroller kit and PC.
14. R8C based applications

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

1. 8085 trainer kit 15 Nos.
2. 8051 trainer kit 15 Nos.
3. 8086 trainer kit 10 Nos.
4. Macro assembler MASM (Simulator) - 10 Users.
5. 8279 Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
6. 8251 Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
7. ADC and DAC Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.

8. Traffic Light - Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
9. Stepper motor Interfacing - Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos.
10. (16X2) LCD Display - Interfacing card compatible with 8085, 8051 and 8086 trainers. – 2 Nos
11. Temperature measurement card - Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos
12. DC motor speed control card- Interfacing card compatible with 8085, 8051 and 8086 trainers – 2 Nos

EC8561

DIGITAL SIGNAL PROCESSING LABORATORY

L T P C

0 0 3 2

DSP PROCESSOR IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. MAC operation using various addressing modes
3. Implementation of difference equations
4. Linear Convolution
5. Circular Convolution
6. Waveform generation

MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of sequences
2. Linear and Circular Convolutions
3. DFT
4. FIR filter design
5. IIR filter design
6. Finite wordlength effects
7. Decimation and Interpolation

TOTAL: 45 PERIODS

LAB REQUIREMENTS:

- TMS 320C5x / TMS 320C6x kits – 15 Nos.
- MATLAB or Equivalent S/w – 15 User License

OBJECTIVE:

- To study about the mechanics involved with various physiological systems.
- To gain knowledge in deriving the mathematical models related to blood vessels.

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-corporeal 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.
3. Joseph d.Bronzino, "Biomedical Engineering Fundamentals", Taylor & Francis, 2006
4. John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction to Biomedical Engineering" Elsevier, 2005
5. B.H. Brown, PV Lawford, RH Smallwood, DR Hose, Dc Barber, Medical Physics and Biomedical Engineering – CRC Press, 1999.

BM8602

DIAGNOSTIC AND THERAPEUTIC EQUIPMENT - II

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

OBJECTIVE:

- To gain knowledge about measurements of parameters related to respiratory system
- To know the measurement of sensory responses
- To learn about the different types and uses of diathermy units
- To study how the ultrasound imaging technique is useful in diagnosis
- To study the importance of patient safety against electrical hazard

UNIT I RESPIRATORY MEASUREMENT SYSTEM

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 II SENSORY MEASUREMENT

9

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

UNIT III DIATHERMY**9**

IR and UV lamp and its application. Short wave diathermy, ultrasonic diathermy, Microwave diathermy, Electro surgery machine - Current waveforms, Tissue Responses, Electro surgical current level, Hazards and safety procedures.

UNIT IV ULTRASONIC TECHNIQUE**9**

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

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

TOTAL: 45 PERIODS**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, 2006.
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical equipment technology”, Pearson education, 2004.

REFERENCES:

1. Richard Aston “Principles of Biomedical Instrumentation and Measurement” – Merrill Publishing Company, 1990.
2. L.A Geddas and L.E.Baker “Principles of Applied Biomedical Instrumentation” – 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. Myer Kutz “Standard Handbook of Biomedical Engineering & Design” – McGraw-Hill Publisher, 2003

6. Antony Y.K.Chan,' Biomedical Device technology, Principles and design', Charles Thomas Publisher Ltd, Illinois, USA, 2008

BM8603

HOSPITAL MANAGEMENT

L T P C

3 0 0 3

OBJECTIVE:

- To enable students understand the principles, practices and areas of application in Hospital management.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 7

Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

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

UNIT III MARKETING RESEARCH & CONSUMER BEHAVIOUR 10

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer Behaviour - Model of consumer behaviour - Types of buying decision behaviour - The buyer decision process - Model of business buyer behaviour - Major types of buying situations - global marketing in the medical sector - WTO and its implications

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES 10

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – Environment Management Systems. NABA, JCI, NABL. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care - Medical Audit – Hazard and Safety in a hospital Setup.

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.

REFERENCES:

1. Cesar A.Caceres and Albert Zara, “The Practice of Clinical Engineering, Academic Press, New York, 1977.
2. Norman Metzger “Handbook of Health Care Human Resources Management”, 2nd edition (1990) - Aspen Publication Inc. Rockville, Maryland, USA
3. Peter Berman “Health Sector Reform in Developing Countries” - Harvard University Press, 1995.
4. William A. Reinke “Health Planning For Effective Management” - Oxford University Press.
5. Health and Social organization: Towards a health policy for the 21st century – Blane, David, Brunner, Eric – Calrendon Press
6. Health Care Management - Arnold D. Kalcizony & Stephen M. Shortell

BM8604**RADIOLOGICAL EQUIPMENT****L T P C
3 0 0 3****OBJECTIVES:**

- To study the generation of x-rays and its uses in Imaging.
- To study the different types of Radio diagnostic techniques.
- To study the special techniques used for visualizing the different sections of the body.
- To know the Radiation therapy methodologies and the Radiation safety.

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 COMPUTED TOMOGRAPHY 9

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors- Viewing systems- spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques- back projection and iterative method.

UNIT III MAGNETIC RESONANCE IMAGING 9

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk Magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system- system Magnet (Permanent, Electromagnet and Super conductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV NUCLEAR MEDICINE SYSTEM 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, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyberknife- radiation measuring instruments- Dosimeter, film Badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

TOTAL: 45 PERIODS.

TEXT BOOKS:

1. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelphia, 1988.
2. R. Hendee and Russell Ritenour “Medical Imaging Physics”, Fourth Edition William, Wiley-Liss, 2002.

REFERENCES:

1. Gopal B. Saha "Physics and Radiobiology of Nuclear Medicine"- Third edition Springer, 2006.
2. B.H.Brown, PV Lawford, R H Small wood , D R Hose, D C Barber, "Medical physics and biomedical Engineering", - CRC Press, 1999.
3. Myer Kutz, "Standard handbook of Biomedical Engineering and design", McGraw Hill, 2003.
4. P.Ragunathan, "Magnetic Resonance Imaging and Spectroscopy in Medicine concepts and Techniques", Orient Longman, 2007.

BM8611 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY

**L T P C
0 0 3 2**

LIST OF EXPERIMENTS:

1. Recording and analysis of ECG signals
2. Recording and analysis of EEG signals.
3. Recording - Fatigue test of EMG signals.
4. Simulation of ECG – detection of QRS complex and heart rate
5. Study of shortwave and ultrasonic diathermy
6. Study of Patient Monitoring System
7. Study of biotelemetry
8. Electrical safety measurements.
9. Analysis of characteristics of surgical diathermy.
10. Measurement of Respiratory parameters using spirometry.
11. Measurement of GSR.
12. Recording of Audiogram.

TOTAL: 45 PERIODS

LAB REQUIREMENTS FOR 30 STUDENTS

| | |
|---|--------|
| Multioutput power supply (+15v, -15v, +30V variable , +5V , 2A) | 2 Nos. |
| ECG recorder with facility for analysis | 1 No. |
| EEG recorder with facility for analysis | 1 No. |
| EMG recorder with facility for analysis | 1 No. |

| | |
|--|-------|
| Short wave Diathermy | 1 No. |
| Ultrasound diathermy | 1 No. |
| Patient Monitoring system | 1 No. |
| Single parameter biotelemetry system | 1 No. |
| Electrical Safety Analyser | 1 No. |
| Surgical Diathermy | 1 No. |
| Spirometry with associated analysis system | 1 No. |
| GSR measurement system | 1 No. |
| Audiometer (With facility to carry out Air Conduction, Bone conduction, SISI test) | 1 No. |
| ECG Simulator | 1 No. |

BM8612 MEDICAL ELECTRONICS SYSTEM DESIGN LAB L T P C
0 0 3 2

This laboratory would focus on training and honing technical skills of the students with regard to design and development of basic prototypes leading to low cost systems applied in the field of Biomedical Engineering. These prototypes will be used either to develop basic level rehabilitation tools and aids or to have decision making or control by the introduction of intelligence in the system. This laboratory is thus to provide a platform for the students to gain knowledge in the development of socially relevant projects in the field of Medical Electronics

TOTAL: 45 PERIODS

BM 8701 MEDICAL INFORMATICS L T P C
3 0 0 3

OBJECTIVE:

To introduce students to ICT applications in medicine with an introduction to health informatics. The student would be taught on the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems.

UNIT I MEDICAL INFORMATICS 9

Introduction – Medical Informatics – Bioinformatics – Health Informatics - Structure of Medical Informatics –Functional capabilities of Hospital Information System - On-line services and Off – line services - History taking by computer, Dialogue with the computer

UNIT II MEDICAL STANDARDS**9**

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA – Electronics Patient Records –Healthcare Standard Organizatios – JCAHO (Join Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

UNIT III MEDICAL DATA STORAGE AND AUTOMATION**9**

Plug-in Data Acquisition and Control Boards – Data Acquisition using Serial Interface - Medical Data formats – Signal, Image and Video Formats – Medical Databases - Automation in clinical laboratories - Intelligent Laboratory Information System - PACS

UNIT IV HEALTH INFORMATICS**9**

Bioinformatics Databases, Bio-information technologies, Semantic web and Bioinformatics, Genome projects, Clinical informatics, Nursing informatics, Public health informatics, Education and Training

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS**9**

Medical Expert Systems, Virtual reality applications in medicine, Virtual Environment - Surgical simulation - Radiation therapy and planning – Telemedicine – virtual Hospitals - Smart Medical Homes – Personalized e-health services – Biometrics - GRID and Cloud Computing in Medicine

TOTAL: 45 PERIODS**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.
3. N.Mathivanan, “PC-Based Instrumentation”, Prentice Hall of India Pvt Ltd – New Delhi – 2007.
4. Orpita Bosu and Simminder Kaur Thukral, “Bioinformatics Databases, Tools and Algorithms”, Oxford University press, 2007, New Delhi.
5. Yi – Ping Phoebe Chen, “Bioinformatics Technolgies”, Springer International Edition, 2007, New Delhi

OBJECTIVES:

- The course will introduce the student to the fundamentals of pattern recognition and its application.
- The course will discuss several supervised and unsupervised algorithms suitable for pattern classification. Particular emphasis will be given to computational methods such as linear discriminant functions and nearest neighbor rule.
- The course also covers basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.
- The major focus of this course will be on the use of Pattern and Neural Classifiers for classification applications.

UNIT I INTRODUCTION AND SUPERVISED LEARNING 9

Overview of Pattern recognition, Types of Pattern recognition, Parametric and Nonparametric approach, Bayesian classifier, Discriminant function, non parametric density estimation, histograms, kernels, window estimators, k- nearest neighbor classifier, estimation of error rates.

UNIT II UNSUPERVISED LEARNING AND CLUSTERING ANALYSIS 9

Unsupervised learning- Hierarchical clustering- Single-linkage Algorithm, Complete –linkage Algorithm, Average-linkage algorithm and Ward’s method. Partitional clustering- Forgy’s Algorithm, k-means algorithm and Isodata Algorithm

UNIT III 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 IV BACK PROPAGATION AND ASSOCIATIVE MEMORY 9

Back propagation network, generalized delta rule, Bidirectional Associative memory Hopfield Network

UNIT V NEURAL NETWORKS BASED ON COMPETITION 9

Kohonen Self organizing map, Learning Vector Quantisation, Counter Propagation network.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

BM8751**PRINCIPLES OF DIGITAL IMAGE PROCESSING****L T P C
3 0 0 3****OBJECTIVES:**

- 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 FUNDAMENTALS**9**

Elements of digital image processing systems, Vidicon and Digital Camera working principles, - Elements of visual perception, brightness, contrast, hue, saturation, mach band effect, Color image fundamentals - RGB, HSI models, Image sampling, Quantization, dither, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT, KLT, SVD.

UNIT II IMAGE ENHANCEMENT**9**

Point processing, Histograms, Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contraharmonic mean filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION**9**

Image Restoration - degradation model, Unconstrained and Constrained restoration, Inverse filtering, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV IMAGE SEGMENTATION**9**

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – Hybrid methods

UNIT V IMAGE COMPRESSION**9**

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson, Education, Inc., Second Edition, 2004.
2. Anil K. Jain, , Fundamentals of Digital Image Processing', Pearson Education, Inc., 2002.

REFERENCES:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2004.
3. D.E. Dudgeon and RM. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, "Digital Image Processing" , John Wiley, New York, 2002
5. Milan Sonka et al, "Image Processing, Analysis and Machine vision", Brookes/Cole, Vikas Publishing House, 2nd edition, 1999
6. Alan C. Bovik, "Handbook of image and video processing" Elsevier Academic press, 2005
7. S.Sridhar, " Digital Image processing" Oxford University press, Edition 2011

LIST OF EXPERIMENTS:

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.
11. Study of DICOM standards.
12. Stegnography
13. Medical Image Compression techniques.

TOTAL:45 PERIODS**REFERENCE:**

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

OBJECTIVES:

- To know the basic principle of techniques
- To implement the engineering aspects in medical sciences

UNIT I ANALYTICAL TECHNIQUES**9**

Principle, instrumentation and application of electrophoresis- SDS, native gel. UV and IR spectroscopy and its application. Spectrophotometry, flame photometry and fluorimetry. NMR – principle, instrumentation and application in medical sciences.

UNIT II ENZYMES AS A DIAGNOSTIC TOOL

9

Isoenzymes and their significance in diagnosis, enzyme pattern in health and diseased condition –lipase, amylase, ALP, ACP,SGOT,SGPT, LDH& CPK. Techniques in screening isoenzymes. Biosensors- enzyme based, antibody based, DNA based and optical biosensor. Blotting techniques. Automation in clinical laboratory.

UNIT III RADIOISOTOPIC TECHNIQUES

9

Types of radioisotopes, units of measurements, methods in measuring radioactivity – G.M liquid scintillation counter application in diagnosis (RIA & ELISA) , autoradiography, biological hazards, safety measures in handling isotopes, disposal of labeled compounds and radiodosimetry

UNIT IV GENE THERAPY

9

Central concept of gene therapy, basic molecular mechanism of gene transfer, human genome project, prerequisite of human gene therapy, biological basis of gene therapy strategies, vehicles for gene transfer, gene transfer methods, clinical gene therapy studies, gene therapy for hereditary disease, gene therapy for cancer, gene therapy for HIV. Ethical issues in human gene therapy.

UNIT V NANOTHERAPEUTICS

9

Nanoparticles as carriers in drug delivery- design, manufacture and Physiochemical properties, transport across biological barriers, nanotechnology in Cancer therapy, bone treatment, nano particles for oral vaccination and skin disease.

TOTAL : 45 PERIODS.

TEXT BOOKS:

- Principles of Instrumental Analysis. By D.A. Skoog
- Keith Wilson & John Walker, “ Practical Biochemistry – Principles and Techniques.”
- Oxford University press.
- Trevor Palmer, “ Understanding Enzymes”, Ellis Horwood.
- Molecular Cell Biology by Lodish et al
- Fundamentals of Nanotechnology December 2008, G. Louis Hornyak, John J. Moore,
- Harry F. Tibbals and Joydeep Dutta

- Introduction to NanoScience, G. Louis Hornyak, Joydeep Dutta, Harry F. Tibbals and Anil K. Rao

BM8002

ADVANCED MICROPROCESSORS

L T P C

3 0 0 3

OBJECTIVES:

- To study the microprocessor architecture.
- To study the addressing modes and instruction set of 8086.
- To impart knowledge on 80186,80286,80386 and 80486 microprocessors.
- To introduce the high performance CISC architecture - PENTIUM
- To introduce the high performance CISC architecture - ARM

UNIT I MICROPROCESSOR ARCHITECTURE

9

Instruction Set – Data formats –Addressing modes – Memory hierarchy –register file – Cache – Virtual memory and paging – Segmentation- pipelining –the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set –Computer principles – RISC versus CISC.

UNIT II 8086 MICROPROCESSOR

9

8086- Architecture, Instruction set, Addressing Modes , Assembly Language Programming, minimum and maximum mode configuration, Strings, Procedures, Macros, Assembler Directives, Interrupts and Interrupt Applications.

UNIT III HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM

9

CPU Architecture- Bus Operations – Pipelining – Branch predication – floating point unit- Operating Modes –Paging – Multitasking – Exception and Interrupts – Instruction set – addressing modes – Programming the Pentium processor.

UNIT IV HIGH PERFORMANCE RISC ARCHITECTURE – ARM

9

Organization of CPU – Bus architecture –Memory management unit - ARM instruction set- Thumb Instruction set- addressing modes – Programming the ARM processor.

Arm instruction set – Exceptions – Conditional Execution – Branch and Branch with link exchange – software interrupt – Data processing instructions – Signed and unsigned byte data transfer instructions – Multiple register transfer instructions – Swap instructions – Architectural support for high level languages – Thumb instruction set – Thumb implementation – applications – writing assembly language programs.

TOTAL : 45 PERIODS

TEXTBOOKS:

1. B.B.Brey, “ The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386,80486 PENTIUM, PENTIUM Pro, PII, PIII & IV Architecture, Programming & Interfacing”, Prentice-Hall of India, 7th Edition, 2006.
2. Andrew N. Sloss, Dominic Symes, Chris Wright “ARM System Developers Guide- Designing and Optimizing System” Elsevier, 2004.

REFERENCES:

- 1 Douglas V.Hall, “Microprocessors and Interfacing”, Tata McGraw Hill, II Edition 1999.
- 2 Mohamed Rafiquzzaman, “Microprocessors and Microcomputer Based System Design”, II Edition, CRC Press, 2007.
- 3 A.K.Ray, K.M. Bhurchandi, “Advanced microprocessors and peripherals”, II Edition, Tata McGraw Hill 2006.
- 4 Nilesh B.Bahadure “Microprocessors –The 8086/8088, 80186/80286, 80386/80486 and the Pentium family”,PHI, 2010.

BM8003**BIO MATERIALS AND ARTIFICIAL ORGANS****L T P C****3 0 0 3****OBJECTIVE**

- To study the characteristics and classification of Biomaterials
- To study about the different metals and ceramics used as biomaterials
- To learn about polymeric materials and combinations that could be used as a tissue replacement implants
- To study the artificial organ developed using these materials

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.
4. Medical Textiles and Biomaterials for Healthcare- Edited by AC ANAND, J F Kennedy, M.MirafTAB, S.Rajendran, Woodhead Publishing Limited 2006
5. Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment Volume Editor D F Williams, VCH Publishers 1992
6. An introduction to Materials in Medicine:BD Ratner, AS Hoffmann,FJ Schoen, JE Lemmons, Academic Press 1996

BM8004

BIOMEMS

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

OBJECTIVE:

To understand

- The various MEMS fabrication techniques.
- Different types of sensors and actuators and their principles of operation at the micro scale level.
- Application of MEMS in different field of medicine.

UNIT I MEMS MATERIALS AND FABRICATION

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 MECHANICAL AND THERMAL SENSORS AND ACTUATORS

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, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor

UNIT III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATORS 9

Parallel plate capacitor, pull in effect, Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Properties of piezoelectric materials, Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

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, dielectrophoresis, microfluid dispenser, microneedle, micropumps-continuous flow system, micromixers

UNIT V APPLICATIONS OF BIOMEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chang Liu, ' Foundations of MEMS', Pearson Education International, New Jersey, USA, 2006
2. Nitaigour Premchand Mahalik, " MEMS", Tata McGraw Hill Publishing Company, New Delhi, 2007
3. Tai Ran Hsu , "MEMS and Microsystems design and manufacture", Tata McGraw Hill Publishing Company, New Delhi, 2002

REFERENCES:

1. Wanjun Wang, Stephen A.Soper,"BioMEMs: Technologies and applications", CRC Press, New York, 2007
2. Marc J. Madou ' Fundamentals of microfabrication: the science of miniaturization', CRC Press, 2002 -
3. Nadim Maluf, Kirt Williams. " An introduction to Microelectromechanical Systems Engineering", Second Edition, Artech House Inc, MA, 2004

characterization, Feature extraction- Wavelet packets, Multivariate component analysis- PCA, ICA

TOTAL: 45 PERIODS

REFERENCES:

1. Arnon Cohen, Bio-Medical Signal Processing Vol I and Vol II, CRC Press Inc., Boca Rato, Florida 1999.
2. Rangaraj M. Rangayyan, 'Biomedical Signal Analysis-A case study approach', Wiley-Interscience/IEEE Press, 2002
3. Willis J. Tompkins, Biomedical Digital Signal Processing, Prentice Hall of India, New Delhi, 2003.
4. Emmanuel C. Ifeachor, Barrie W.Jervis, 'Digital Signal processing- A Practical Approach' Pearson education Ltd., 2002
5. Raghuveer M. Rao and Ajith S.Bopardikar, Wavelets transform – Introduction to theory and its applications, Pearson Education, India 2000.
6. K.P.Soman, K.I Ramachandran, "Insight into wavelet from theory to practice", PHI, New Delhi, 2004
7. John L.Semmlow, " Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc., New York, 2004
8. Kavyan Najarian and Robert Splerstor, " Biomedical signals and Image processing", CRC – Taylor and Francis, New York, 2006
9. D.C.Reddy, "Biomedical Signal Processing – Principles and Techniques", TMH, New Delhi, 2005
10. Gari D.Clifford, Francisco Azuaje and Patrick E.McSharry, " Advanced Methods and Tech for ECG Data Analysis", ARTECH House, Boston, 2006.

BM8006

BIOMATERIALS AND CHARACTERIZATION

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

OBJECTIVES:

- To focus on the importance of biomaterials in medicine
- To study the application of materials in solving the problems in medicine
- To highlight the characteristic features of biomaterial

UNIT I BIOMATERIALS AND PROPERTIES 7

Biomaterials: Introduction to biomaterials and requirements of biomaterials, Classification of biomaterials: Metallic, Ceramic, Polymeric and biological biomaterials. Properties of biomaterials: Bulk properties and Surface properties.

UNIT II BIOMATERIALS IN MEDICINE 10

Materials for Bone and Joint Replacement: Metals in Joint Replacement: Stainless Steels, Titanium based Materials and Porous metals. Ceramics: Alumina, Zirconia, Calcium phosphate and bioactive glass, bone cement. Polymers: PMMA and Polyethylene, Rubber and Fluorocarbon polymers. Materials for Oral and Maxillofacial Surgery, Drug Delivery, Ophthalmology and Overview of intelligent textiles for medical application.

UNIT III PHYSIO-CHEMICAL CHARACTERIZATION 10

Material Characterization: X-ray Diffraction Analysis (XRD), X-ray absorption, FT-Raman and micro Raman analysis, Electron Spectroscopy for Chemical Analysis (ESCA) and X-ray Photoelectron Spectroscopy (XPS), Mechanical testing: tensile, compression, wears, fatigue, corrosion studies and fracture toughness. Thermal and Viscoelastic Properties, Acoustic and Ultrasonic properties.

UNIT IV SURFACE CHARACTERIZATION 9

Surface properties and Adhesion, Contact angle Measurement, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM) and Atomic Force Microscopy (AFM). Secondary Ion Mass Spectrometry, Confocal Laser Scanning Microscopy

UNIT V BIOMATERIAL TESTING 9

Biofunctionality and Biocompatibility, Preservation techniques for Biomaterials, In vitro and In vivo Assessment of Tissue compatibility, Testing of Blood –Materials, Interactions and Animal Models.

TEXT BOOKS:

1. Sujata V. Bhatt, "Biomaterials" Second Edition, Narosa Publishing House, 2005.
2. Joon B. Park, Joseph D. Bronzino, "Biomaterials - Principles and Applications" – CRC Press, 2003
3. H.H. Willard, "Instrumental Methods of Analysis", CBS Publishers 1992

REFERENCES:

1. Park J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
2. Myer Kutz "Standard Handbook of Biomedical Engineering & Design" – McGraw-Hill, 2003
3. John Enderle, Joseph D. Bronzino, Susan M. Blanchard, "Introduction to Biomedical Engineering", Elsevier, 2005.
4. Medical Textiles and Biomaterials for Healthcare- Edited by AC ANAND, J F Kennedy, M.Miraftab, S.Rajendran, Woodhead Publishing Limited 2006
5. Materials Science and Technology: Volume 14, Medical and Dental Materials: A comprehensive Treatment: Volume Editor D F Williams, VCH Publishers 1992
6. BD Ratner, AS Hoffmann, FJ Schoen, JE Lemmons, "An introduction to Materials in Medicine", Academic Press, 1996.

BM8007

BIOMETRIC SYSTEMS

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

OBJECTIVE:

- To understand the technologies of fingerprint, iris, face and speech recognition
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To recognize personal privacy and security implications of biometrics based identification technology.
- To identify issues in the realistic evaluation of biometrics based systems.

UNIT I INTRODUCTION TO BIOMETRICS

9

Introduction and back ground – biometric technologies – passive biometrics – active biometrics - Biometric systems – Enrollment – templates – algorithm – verification - Biometric applications – biometric characteristics- Authentication technologies –Need for strong authentication - Protecting privacy and biometrics and policy – Biometric applications – biometric characteristics

UNIT II FINGERPRINT TECHNOLOGY

9

History of fingerprint pattern recognition - General description of fingerprints - Finger print feature processing techniques - fingerprint sensors using RF imaging techniques - fingerprint

quality assessment – computer enhancement and modeling of fingerprint images – fingerprint enhancement – Feature extraction – fingerprint classification – fingerprint matching -

UNIT III FACE RECOGNITION AND HAND GEOMETRY 9

Introduction to face recognition, Neural networks for face recognition – face recognition from correspondence maps – Hand geometry – scanning – Feature Extraction -Adaptive Classifiers - Visual-Based Feature Extraction and Pattern Classification - feature extraction – types of algorithm – Biometric fusion

UNIT IV MULTIMODAL BIOMETRICS AND PERFORMANCE EVALUATION 9

Voice Scan – physiological biometrics –Behavioral Biometrics - Introduction to multimodal biometric system – Integration strategies –Architecture –level of fusion –combination strategy – training and adaptability – examples of multimodal biometric systems – Performance evaluation - Statistical Measures of Biometrics – FAR – FRR – FTE – EER – Memory requirement and allocation

UNIT V BIOMETRIC AUTHENTICATION 9

Introduction - Biometric Authentication Methods - Biometric Authentication Systems - Biometric authentication by fingerprint -Biometric Authentication by Face Recognition. -. Expectation-Maximization theory - . Support Vector Machines. Biometric authentication by fingerprint – biometric authentication by hand geometry- Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC) - Multibiometrics and Two-Factor Authentication

TOTAL: 45PERIODS

REFERENCES :

1. Paul Reid,” Biometrics for Network Security, Pearson Education, 2004
2. Nalini K Ratha, Ruud Bolle, “Automatic fingerprint recognition system, Springer” 2003
3. L C Jain, I Hayashi, S B Lee, U Halici, “Intelligent Biometric Techniques in Fingerprint and Face Recognition”
4. S.Y. Kung, S.H. Lin, M.W., “MakBiometric Authentication: A Machine Learning Approach”
5. John Chirillo, Scott Blaul, “**Implementing Biometric Security**”, John Wiley, 2003

OBJECTIVES:

- To introduce the basic concepts of brain computer interface
- To study the various signal acquisition methods
- To study the signal processing methods used in BCI

UNIT I INTRODUCTION TO BCI 9

Fundamentals of BCI – Structure of BCI system – Classification of BCI – Invasive, Non-invasive and Partially invasive BCI – EEG signal acquisition - Signal Preprocessing – Artifacts removal

UNIT II ELECTROPHYSIOLOGICAL SOURCES 9

Sensorimotor activity – Mu rhythm, Movement Related Potentials – Slow Cortical Potentials - P300 - Visual Evoked Potential - Activity of Neural Cells - Multiple Neuromechanisms

UNIT III FEATURE EXTRACTION METHODS 9

Time/Space Methods – Fourier Transform, PSD – Wavelets – Parametric Methods – AR, MA, ARMA models – PCA – Linear and Non-Linear Features

UNIT IV FEATURE TRANSLATION METHODS 9

Linear Discriminant Analysis – Support Vector Machines - Regression – Vector Quantization – Gaussian Mixture Modeling – Hidden Markov Modeling – Neural Networks

UNIT V APPLICATIONS OF BCI 9

Functional restoration using Neuroprosthesis - Functional Electrical Stimulation, Visual Feedback and control - External device controllers, Case study of Brain actuated control of mobile Robot.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Spehlmann, "EEG Primer", Elsevier Biomedical Press, 1981.
2. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, "Brain-Computer Interfaces: Revolutionizing Human-Computer Interaction", Springer, 2010

REFERENCES:

1. Arnon Kohen, "Biomedical Signal Processing", Vol I and II, CRC Press Inc, Boca Rato, Florida.
2. Bishop C.M., "Neural networks for Pattern Recognition", Oxford, Clarendon Press, 1995.

BM8009

COMPUTER HARDWARE AND INTERFACING

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

OBJECTIVE:

Computers would be the backbone of most of the systems in the coming years. Every student should be conversant with the computer hardware and its interfacing peripherals. This course introduces 8086 family of processors, motherboards, PC based data acquisition and troubleshooting of PCs.

UNIT I INTEL ADVANCED PROCESSORS 9

8086, 80186, 80286, 80386, 80486 -Architecture, Memory management.

UNIT II PENTIUM PROCESSORS 9

Pentium Architecture- Memory Management- Pentium Pro microprocessors – Pentium II, Pentium III , Pentium 4 – Special features and software changes.

UNIT III PC HARDWARE OVERVIEW 9

Functional units & Interconnection, New generation motherboards 286 to Pentium 4 Bus interface – ISA – EISA- VESA- PCI- PCIX, Memory and I/O port addresses, Peripheral interfaces and controller.

UNIT IV PC BASED DATA ACQUISTION 9

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.

UNIT V TROUBLESHOOTING, MAINTAINING & REPAIRING**9**

Memory troubleshooting, Monitor troubleshooting, Motherboard troubleshooting, Port troubleshooting, Sound Boards and Video adapters troubleshooting, USB troubleshooting.

TOTAL : 45 PERIODS**TEXTBOOKS:**

1. B. Govindarajalu, "IBM PC and clones Hardware, Trouble Shooting and Maintanance", Second Edition, Tata McGraw Hill, New Delhi, 2005.
2. N.Mathivanan, " PC –Based Instrumentation Concepts and Practice", Prentice Hall of india, New Delhi, 2007.
3. Stephen J. Bigelow, " Troubleshooting, Maintaining &Repairing", Tata McGraw Hill Edition, 5th Edition.

REFERENCES:

1. Douglus v.Hall, "Microprocessors 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.

EC8011**EMBEDDED AND REAL - TIME SYSTEMS****L T P C
3 0 0 3****OBJECTIVE**

- To study the architecture and programming of ARM processor.
- To introduce the basic concepts of hard real time multiprocessing.
- To introduce the analysis concepts for effective programming .
- To study about the basics of the buses used for embedded system networking.

UNIT I INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS**9**

Complex systems and microprocessors– Embedded system design process – Formalism for system design– Design example: Model train controller- ARM Processor Fundamentals- Instruction Set and Programming using ARM Processor.

UNIT II COMPUTING PLATFORM**9**

CPU: Programming input and output – Supervisor mode, exception and traps – Coprocessor

– Memory system mechanism – CPU performance – CPU power consumption- CPU buses – Memory devices – I/O devices – Component interfacing- System Level Performance Analysis- Parallelism. Design Example : Data Compressor.

UNIT III PROGRAM DESIGN AND ANALYSIS 9

Program design – Model of programs – Assembly and Linking – Basic compilation techniques – Program Optimization- Analysis and optimization of execution time, power, energy, program size – Program validation and testing- Example : Software Modem.

UNIT IV PROCESS AND OPERATING SYSTEMS 9

Multiple tasks and Multi processes – Processes – Context Switching – Operating Systems –Priority based Scheduling- RMS and EDF - Inter Process Communication mechanisms – Evaluating operating system performance – Power optimization strategies for processes.

UNIT V HARDWARE ACCELERATORS & NETWORKS 9

Multiprocessors- CPUs and Accelerators – Performance Analysis- Distributed Embedded Architecture – Networks for Embedded Systems: - I²C, CAN Bus, SHARC link supports, Ethernet, Myrinet – Network based design – Internet enabled systems. Design Example: Digital Still Camera – Video Accelerator.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Wayne Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Morgan Kaufmann Publisher (An imprint from Elsevier), Second Edition, 2008.
2. Andrew N Sloss, Dominic Symes, Chris Wright, “ARM System Developer’s Guide- Designing and Optimizing System Software”, Elsevier/Morgan Kaufmann Publisher, 2008.

REFERENCES:

1. David E-Simon, “An Embedded Software Primer”, Pearson Education, 2007.
2. K.V.K.K.Prasad, “Embedded Real-Time Systems: Concepts, Design & Programming”, Dreamtech press, 2005.
3. Jane.W.S. Liu, “Real-Time systems”, Pearson Education Asia.
4. Sriram V Iyer, Pankaj Gupta, “Embedded Real Time Systems Programming”, Tata Mc-Graw Hill, 2004.
5. Tammy Noergaard, “Embedded Systems Architecture”, Elsevier,2006.

OBJECTIVE:

On completion of the course, the student will know about the optical properties of the tissues and the applications of laser in diagnosis and therapy.

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9

Refraction, Scattering, Absorption, Light transport inside the tissue, Tissue properties, Laser Characteristics as applied to medicine and biology-Laser tissue Interaction-Chemical-Thermal-Electromechanical – Photoablativ processes.

UNIT II INSTRUMENTATION IN PHOTONICS 9

Instrumentation for absorption, Scattering and emission measurements, excitation light sources – high pressure arc lamp, LEDs, Lasers, Optical filters, - optical detectors - Time resolved and phase resolved detectors.

UNIT III SURGICAL APPLICATIONS OF LASERS 9

Lasers in ophthalmology- Dermatology –Dentistry-Urology-Otolaryngology- Tissue welding.

UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS 9

Optical coherence tomography, Elastography, Laser Induced Fluorescence (LIF)-Imaging, FLIM Raman Spectroscopy and Imaging, FLIM – Holographic and speckle application of lasers in biology and medicine.

UNIT V THERAPEUTIC APPLICATIONS 9

Phototherapy, Photodynamic therapy (PDT) - Principle and mechanism - Oncological and non-oncological applications of PDT - Biostimulation effect – applications-Laser Safety Procedures.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Markolf H.Niemz, “Laser-Tissue Interaction Fundamentals and Applications”, Springer, 2007.
2. Paras N. Prasad, “Introduction to Biophotonics”, A. John Wiley and sons, Inc. Publications, 2003.

4. Richard Skalak and Shu Chien , Hand Book of Biomedical Engineering , McGraw Hill and Co.New York, 1987.
5. Douglas S.Rigg. Control Theory and Physiological Feedback Mechanism, The Wilkiam and Wilkins Co. Baltimore, 1970.

BM8014

PRINCIPLES OF TISSUE ENGINEERING

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

OBJECTIVES:

- Introduction of Tissue Engineering
- Cell cycle and differentiation
- Basics about stem cells and its applications
- Different synthetic and biomaterials in tissue replacements
- Application of Tissue Engineering

UNIT I FUNDAMENTALS OF TISSUE ENGINEERING

9

Tissue exchange and tissue development - Objectives of tissue engineering - Laboratory set up for tissue engineering. Cell cycle and differentiation - cell adhesion - cell adhesion molecules - cell migration - cell aggregation and tissue equivalent.

UNIT II STEM CELLS

9

Definition of stem cells – types of stem cells – differentiation, dedifferentiation maturation, proliferation, pluripotency and immortalization. Sources of stem cells: haematopoietic – fetal - cord blood – placenta - bone marrow - primordial germ cells - cancer stem cells - induced pluripotent stem cells.

UNIT III COMPONENTS OF TISSUE ENGINEERING

9

Cell and Drug delivery systems - Transplantation – Implantation - Synthetic components – nanotechnology in tissue engineering – Imaging methods: SEM, TEM, Fluorescent and Confocal microscopy.

UNIT IV MATERIALS IN TISSUE ENGINEERING**9**

Biological materials – degradable and non degradable – extra cellular matrix – decellularization
- Polymers: synthetic and natural – cell interaction with polymers – applications of polymer.

UNIT V APPLICATION OF TISSUE ENGINEERING**9**

Replacement Engineering: Artificial organs – cartilage, skin blood, pancreas, kidney and liver. Regenerative engineering: Nerve regeneration – cardiac tissue regeneration – muscle regeneration.

TOTAL : 45 PERIODS**TEXT BOOKS:**

1. W. Mark Saltzman, Tissue Engineering – Engineering principles for design of replacement organs and tissue – Oxford University Press Inc New York, 2004.
2. Stem cells – Elsevier: CS Potten, 1997.

REFERENCES:

1. Gray E. Wnek, Gray L Browlin – Encyclopedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.
2. R. Lanza, J. Gearhart et al (Eds), Essential of Stem Cell Biology, 2006, Elsevier Academic press.
3. R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, Handbook of Stem Cells, TwoVolume, Volume 12: Volume 1. Embryonic Stem Cells; Volume 2. Adult & Fetal Stem Cells, 2004, Academic Press.

BM8015**REHABILITATION ENGINEERING****L T P C****3 0 0 3****OBJECTIVES:**

On completion of the course the student will be able to

1. Explain the need for medical aids.
2. Devise new concepts for future development and applications.
3. Have a understanding of the sensory rehabilitation systems.
4. Have a understanding of the orthopedic prosthetics and orthotics in rehabilitation.
5. Have a understanding of rehabilitation medicine and advocacy.

UNIT I INTRODUCTION 9

Definition of rehabilitation Engineering, Impairments, disabilities and handicaps, Measurement and assessment. Rehabilitation Engineering : Fundamental principles, structure, function; performance and behavior. Subjective and objective measurement methods.

UNIT II ENGINEERING CONCEPTS IN SENSORY REHABILITATION ENGINEERING 9

Sensory augmentation and substitution: Visual system: Visual augmentation, Tactual vision substitution, and Auditory vision substitution. Auditory system: Auditory augmentation, Audiometer, Hearing aids, cochlear implantation, visual auditory substitution, tactual auditory substitution, and Tactual system: Tactual augmentation, Tactual substitution.

UNIT III ORTHOPEDIC PROSTHETICS AND ORTHOTICS IN REHABILITATION 9

Engineering concepts in motor rehabilitation, applications. Artificial limb & hands, Externally powered & controlled orthotics & prosthetics, Myoelectric hand & arm prostheses. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS)

UNIT IV VIRTUAL REALITY IN REHABILITATION 9

Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation

UNIT V REHABILITATION MEDICINE AND ADVOCACY 9

Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in day-to-day life.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Bronzino, Joseph; Handbook of biomedical engineering. 2nd edition, CRC Press, 2000.
2. Robinson C.J; Rehabilitation engineering. CRC press 1995
3. Sashi S Kommu; Rehabilitation Robotics, 1 edition, CRC Press, 2007

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXTBOOK;

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

WEB SOURCES:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

MG8654**TOTAL QUALITY MANAGEMENT****L T P C****3 0 0 3****AIM**

- To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve quality.
- To learn the various statistical approaches for Quality control.

- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality - Basic concepts of TQM – TQM Framework - Contributions of Quality Gurus – Barriers to TQM – Cost of Quality.

UNIT II TQM PRINCIPLES 9

Quality statements - Customer focus –Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Continuous process improvement – PDCA 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 – Performance measures - BPR.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits –Quality Council – Leadership, Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward.

TOTAL : 45 PERIODS

TEXT BOOK:

1. Dale H. Besterfield, et al., “Total Quality Management”, Pearson Education Asia, Third 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, Third 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.

CS8251

**DATA STRUCTURES AND OBJECT ORIENTED
PROGRAMMING IN C++**

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

OBJECTIVES:

This course comprehends the fundamentals of object oriented programming, particularly in C++, which are then used to implement data structures. This also gives an idea of linear and non-linear data structures and their applications.

UNIT – I DATA ABSTRACTION & OVERLOADING

9

Overview of C++ – Structures – Class Scope and Accessing Class Members – Reference Variables – Initialization – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members – Container Classes and Integrators – Proxy Classes – Overloading: Function overloading and Operator Overloading.

UNIT – II INHERITANCE & POLYMORPHISM

9

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – Implicit Derived – Class Object To Base – Class Object Conversion – Composition Vs. Inheritance – Virtual functions – This Pointer – Abstract Base Classes and Concrete Classes – Virtual Destructors – Dynamic Binding.

UNIT – III LINEAR DATA STRUCTURES

11

Asymptotic Notations: Big-Oh, Omega and Theta – Best, Worst and Average case Analysis: Definition and an example – Arrays and its representations – Stacks and Queues – Linked lists – Linked list based implementation of Stacks and Queues – Evaluation of Expressions – Linked list based polynomial addition.

UNIT – IV NON-LINEAR DATA STRUCTURES

9

Trees – Binary Trees – Binary tree representation and traversals – Threaded binary trees – Binary tree representation of trees – Application of trees: Set representation and Union-Find operations – Graph and its representations – Graph Traversals – Connected components.

UNIT – V SORTING & SEARCHING

7

Insertion sort – Merge sort – Quick sort – Heap sort – Linear Search – Binary Search.

TOTAL: 45PERIODS

TEXTBOOKS:

1. Deitel and Deitel, “ C++, How To Program”, Fifth Edition, Pearson Education, 2005.
2. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, Fundamentals of Data Structures in C++, Galgotia, New Delhi, 1995.

REFERENCES:

1. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Third Edition, Addison-Wesley, 2007.
2. Bhushan Trivedi, “ Programming with ANSI C++, A Step-By-Step approach”, Oxford University Press, 2010.
3. Goodrich, Michael T., Roberto Tamassia, “David Mount. Data Structures and Algorithms in C++”, 7th ed, Wiley. 2004.

EC8071

CRYPTOGRAPHY AND NETWORK SECURITY

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

OBJECTIVES:

- To teach the importance of security for networks
- To teach the basics of number theory and galois field concepts
- To teach symmetric and asymmetric key in crypto systems
- To teach authentication and key management techniques
- To teach security specific to network layer

2. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security Private Communication in a Public World", Pearson Education, Second Edition, 2003.

**EC8072 ELECTRO MAGNETIC INTERFERENCE AND COMPATIBILITY L T P C
3 0 0 3**

OBJECTIVE

- To tutor the basics of EMI,EMC
- To instill knowledge on the EMI coupling mechanism and its mitigation techniques
- To impart comprehensive insight about the current EMC standards and about various measurement techniques

UNIT I BASIC CONCEPTS 7

Definition of EMI and EMC; Intra and Inter system EMI; Sources and victims of EMI, Conducted and Radiated EMI emission and susceptibility; Transient & ESD; Case Histories; Radiation Hazards to humans.

UNIT II COUPLING MECHANISM 9

Common mode coupling; Differential mode coupling; Common impedance coupling; Ground loop coupling; Field to cable coupling; Cable to cable coupling; Power mains and Power supply coupling.

UNIT III EMI MITIGATION TECHNIQUES 10

Shielding – principle, choice of materials for H, E and free space fields, and thickness; EMI gaskets; Bonding; Grounding – circuits, system and cable grounding; Filtering; Transient EMI control devices and applications; PCB Zoning, Component selection, mounting, trace routing.

UNIT IV STANDARDS AND REGULATION 7

Units of EMI; National and International EMI Standardizing Organizations – IEC, ANSI, FCC, CISPR, BIS, CENELEC; FCC standards; EN Emission and Susceptibility standards and specifications; MIL461E Standards.

EMI test sites - Open area site; TEM cell; Shielded chamber; Shielded Anechoic chamber; EMI test receivers; Spectrum Analyzer; Transient EMI Test wave Simulators; EMI coupling Networks - Line impedance Stabilization Networks; Feed through capacitors; Antennas and factors; Current probes and calibration factor; MIL-STD test methods; Civilian STD Test methods.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. V.P. Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork,2001
2. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.

REFERENCES:

1. Don R.J.White Consultant Incorporate, "Handbook of EMI/EMC", Vol I-V, 1988.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1987

OBJECTIVE:

The objective of the course is to introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems

Particles, waves, probability amplitudes, schrodinger equation, wavepackets solutions, operators, expectation values, eigenfuntions, piecewise constant potentials.

SHM Operators, SHM wavepacket solutions, Quantum LC circuit, WKB approximations, variational methods.

REFERENCES:

1. Marcus goncalves "Voice over IP Networks", McGraw Hill,
2. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007
3. R. Steimnetz, K. Nahrstedt, "Multimedia Computing, Communications and Applications", Pearson Education, First ed, 1995.
4. Ranjan Parekh, "Principles of Multimedia", TMH, 2006

EC8075

ROBOTICS

L T P C
3 0 0 3

OBJECTIVES:

- To introduce the electronics and software aspects in robots
- To bring out the different languages for programming robot
- To specify robot requirements in the industry
- To introduce latest state of the art robots

UNIT I SCOPE OF ROBOTS

4

The scope of industrial Robots - Definition of an industrial robot - Need for industrial robots –Economic and Social Issues- applications.

UNIT II ROBOT COMPONENTS

9

Fundamentals of Robot Technology - Automation and Robotics - Robot anatomy - Work volume - Precision of movement - End effectors - Sensors.

UNIT III ROBOT PROGRAMMING

9

Robot Programming - Methods - interlocks textual languages. Characteristics of Robot level languages, characteristic of task level languages.

UNIT IV ROBOT WORK CELL

9

Robot Cell Design and Control - Remote Center compliance - Safety in Robotics.

Advanced robotics, Advanced robotics in Space - Specific features of space robotics systems - long-term technical developments, Advanced robotics in under - water operations. Robotics Technology of the Future - Future Applications.

TOTAL : 45 PERIODS

TEXTBOOK:

1. Barry Leatham - Jones, "Elements of industrial Robotics" PITMAN Publishing , 1987.

REFERENCES:

1. Mikell P.Groover, Mitchell Weiss, Roger N.Nagel Nicholas G.Odrey, "Industrial Robotics Technology, Programming and Applications ", McGraw Hill Book Company 1986.
2. Fu K.S. Gonzaleaz R.C. and Lee C.S.G., "Robotics Control Sensing, Vision and Intelligence " McGraw Hill International Editions, 1987.
3. Bernard Hodges and Paul Hallam, " Industrial Robotics", British Library Cataloging in Publication 1990.
4. Deb, S.R. Robotics Technology and flexible automation, Tata Mc GrawHill, 1994.

EC8076

SOFT COMPUTING AND APPLICATIONS

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

OBJECTIVES:

- This course gives an idea and principles of various soft computing techniques, which are applicable to core areas such as networks , pattern recognition, image processing
- To introduce fuzzy set theory
- To teach different optimization techniques
- To introduce neural networks and neuro-fuzzy modeling
- To teach various applications of computational intelligence

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

3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.
4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence - PC Tools", AP Professional, Boston, 1996.
5. Dr.S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India, 2007.
6. Amit Konar, "Artificial Intelligence and Soft Computing Behaviour and Cognitive model of the human brain", CRC Press, 2008.

EC8451

COMPUTER ARCHITECTURE AND ORGANIZATION

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

OBJECTIVES:

- To study the general purpose architecture for computer system .
- To study the design of data path unit and control unit for ALU operation.
- Understanding the concept of various memories.
- To introduce the concept of interfacing and organization of multiple processors.

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. Varanescic and Safat G. Zaky, " Computer Organisation", V edition, McGraw-Hill Inc, 1996.

REFERENCES:

1. Morris Mano, "Computer System Architecture", Prentice-Hall of India, 2000.
2. Behrooz Paraami, "Computer Architecture, From Microprocessor to Supercomputers", , Oxford University Press, Sixth impression 2010.
3. P.Pal Chaudhuri, , "Computer organization and design", 2nd Ed., Prentice Hall of India, 2007.
4. Miles J. Murdocca and Vincent P. Heuring, Principles of Computer Architecture, Printice Hall, 2000
5. William Stallings, "Computer Organisatin and Architecture, Designing for Performance, Pearson Education, Eighth Edition 2010.

EC8651**DIGITAL VLSI****L T P C
3 0 0 3****OBJECTIVES:**

- In this course, the MOS circuit realization of the various building blocks that is common to any microprocessor or digital VLSI circuit are studied.
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed.

REFERENCES:

1. N.Weste, K.Eshraghian, "Principles of CMOS VLSI DESIGN", second edition, Addison Wesley 1993
2. R.Jacob Baker, Harry W.Li., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", 2005 Prentice Hall of India
3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI DESIGN", Third edition, Prentice Hall of India, 2007.