
# VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

**NAAC ACCREDITED**

PALLAVARAM - CHENNAI - INDIA

## School of Engineering
## B.E Biomedical Engineering

**Programme Outcome of B.E / B.Tech Programme:**

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based Knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities

and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAME SPECIFIC OUTCOME

Upon completion of the B.E. in Biomedical Engineering, students will demonstrate the ability to:

PSO1: Apply knowledge of basic lifescience, mathematics and engineering to model a medical system with varying complexity

PSO2: To design a system, component, or process andto analyze data to meet the needs of the society.

PSO3:Communicate efficiently to an audience of multidisciplinary nature and to prepare technical documents and to present effectively

PSO4: Ability to understand ethical and professional responsibilities

PSO5:Critically analyse the current healthcare systems and develop innovative solutions

PSO6:Understand the need and possess the ability for lifelong learning to have continuous professional development

PSO7:Use the techniques, skills and modern engineering tools necessary for engineering practice.

# School of Engineering

# Department of Biomedical Engineering

The details of the suggested Board of Members for the Department of Biomedical Engineering are shown below :

| S. No | Name of the Board Member | Designation | Institute / Industry |
|---|---|---|---|
| **Internal Members** | | | |
| 1 | Ms. Hemalatha.R.J | HOD & Convener | Vels University |
| 2 | Ms. Josline Elsa Joseph | Assistant Professor | Vels University |
| **External Expert Members** | | | |
| 1 | Dr. V.Vijayabaskar | Professor and Head | Sathyabama University, Chennai |
| 2 | Dr. Hariharan | Associate Professor | SRM University, Chennai |
| 3 | Dr. Venkat sai | Professor and Head | Sri Ramachandra university - SRMC,Chennai |
| 4 | Mr. B. Venkatraman | Managing Partner (Technical) | Biovision Medical Systems, Chennai. |
| 5 | Mr. Balachandar.S | Biomedical - Technical Trainer | Helix Corporation |

VELS

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)

(DEEMED TO BE UNIVERSITY Estd. u/s 3 OF THE UGC ACT, 1956)

NAAC ACCREDITED

PALLAVARAM - CHENNAI - INDIA

# B.E.

## Biomedical Engineering

**Curriculum and Syllabus**

(Based on Choice Based Credit System)

Effective from the Academic year

**2015-2016**

# Department of Bio-Engineering
# School of Engineering

B.E. BIOMEDICAL ENGINEERING
CURRICULUM

Total Number of Credits: 195

| Category | Code No. | Course | Hours/Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | **L**ecture | **T**utorial | **P**ractical | |
| **SEMESTER I** | | | | | | |
| AECC | 15GBE201 | Technical English | 3 | 0 | 0 | 3 |
| CORE | 15GBE001 | Mathematics – I | 3 | 1 | 0 | 3 |
| CORE | 15GBE002 | Engineering Physics | 3 | 1 | 0 | 3 |
| CORE | 15GBE003 | Fundamentals of Computing | 3 | 1 | 0 | 3 |
| CORE | 15GBE004 | Engineering Graphics | 2 | 0 | 3 | 4 |
| CORE | 15GBE005 | Engineering Practices Laboratory | 0 | 0 | 3 | 2 |
| CORE | 15GBE006 | Engineering Physics Lab | 0 | 0 | 3 | 2 |
| CORE | 15GBE007 | Computer Practice Laboratory | 0 | 0 | 3 | 2 |
| | | **TOTAL** | **14** | **3** | **12** | **22** |
| **SEMESTER II** | | | | | | |
| Category | Code No. | Course | Hours/Week | | | Credits |
| | | | **L**ecture | **T**utorial | **P**ractical | |
| AECC | 15GBE202 | Communication Skills | 3 | 0 | 0 | 3 |
| AECC | 15GBE203 | Language Lab | 0 | 0 | 3 | 2 |
| CORE | 15EBM001 | Human Physiology | 3 | 1 | 0 | 3 |
| CORE | 15EBM002 | Biochemistry | 3 | 0 | 0 | 3 |
| CORE | 15GBE009 | Engineering Chemistry | 3 | 1 | 0 | 3 |
| CORE | 15GBE008 | Mathematics II | 3 | 1 | 0 | 4 |
| CORE | 15GBE010 | Materials Science | 3 | 0 | 0 | 3 |
| CORE | 15EBM003 | Biochemistry and Human Physiology Lab | 0 | 0 | 3 | 2 |
| CORE | 15GBE011 | Engineering Chemistry Lab | 0 | 0 | 3 | 2 |
| | | **TOTAL** | **18** | **3** | **9** | **25** |

**B.E. Biomedical Engineering**
**CURRICULUM**

| Category | Code No. | Course | Hours/Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | **L**ecture | **T**utorial | **P**ractical | |
| **SEMESTER III** | | | | | | |
| AECC | 15GBE204 | Environmental Science and Engineering | 3 | 0 | 0 | 3 |
| CORE | 15GBE012 | Mathematics III | 3 | 1 | 0 | 3 |
| CORE | 15EBM004 | Pathology and Microbiology | 3 | 1 | 0 | 3 |
| CORE | 15EBM005 | Biomaterials and Artificial Organs | 3 | 0 | 0 | 3 |
| CORE | 15EBM006 | Biocontrol system | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective I | 3 | 0 | 0 | 3 |
| GE | 15EBM… | Generic Elective I | 3 | 0 | 0 | 3 |
| CORE | 15EBM007 | Pathology and Microbiology Laboratory | 0 | 0 | 3 | 2 |
| DSE | 15EBM… | Discipline Specific Elective II Laboratory | 0 | 0 | 3 | 2 |
| | | **TOTAL** | **21** | **3** | **6** | **25** |
| **SEMESTER IV** | | | | | | |
| Category | Code No. | Course | Hours/Week | | | Credits |
| | | | **L**ecture | **T**utorial | **P**ractical | |
| CORE | 15GBE015 | Statistics and Numerical Methods | 3 | 1 | 0 | 4 |
| CORE | 15EBM008 | Medical Physics | 3 | 0 | 0 | 3 |
| CORE | 15EBM009 | Microprocessor, Microcontroller and System Design | 3 | 1 | 0 | 3 |
| CORE | 15EBM010 | Electronic Circuits | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective III | 3 | 1 | 0 | 3 |
| GE | 15EBM… | Generic Elective II | 3 | 0 | 0 | 3 |
| SEC | 15EBM… | Skill Enhancement Elective II | 2 | 0 | 0 | 2 |
| CORE | 15EBM011 | Microprocessor and Microcontroller Laboratory | 0 | 0 | 3 | 2 |
| CORE | 15EBM012 | Electronic Circuits Laboratory | 0 | 0 | 3 | 2 |
| CORE | 15BESY41 | Basic Life Skills | 1 | 0 | 1 | 2 |
| | | **TOTAL** | **20** | **4** | **6** | **27** |

**B.E. Biomedical Engineering**
**Curriculum**

| Category | Code No. | Course | Hours/Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | **L**ecture | **T**utorial | **P**ractical | |
| **SEMESTER V** | | | | | | |
| CORE | 15EBM014 | Biomedical Instrumentation | 3 | 1 | 0 | 4 |
| CORE | 15EBM019 | Diagnostic and Therapeutic Equipment | 3 | 1 | 0 | 3 |
| CORE | 15EBM016 | Medical Optics | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective IV | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective V | 3 | 0 | 0 | 3 |
| GE | 15EBM… | Generic Elective III | 3 | 0 | 0 | 3 |
| SEC | 15EBM… | Skill Enhancement Elective III | 2 | 0 | 0 | 2 |
| CORE | 15EBM017 | Biomedical Instrumentation Laboratory | 0 | 0 | 3 | 2 |
| CORE | 15EBM023 | Diagnostic and Therapeutic Equipment Lab | 0 | 0 | 3 | 2 |
| | | **TOTAL** | **20** | **4** | **6** | **26** |
| **SEMESTER VI** | | | | | | |
| Category | Code No. | Course | Hours/Week | | | Credits |
| | | | **L**ecture | **T**utorial | **P**ractical | |
| CORE | 15EBM019 | Diagnostic and Therapeutic Equipment | 3 | 1 | 0 | 3 |
| CORE | 15EBM020 | Digital Signal Image processing | 3 | 1 | 0 | 3 |
| CORE | 15EBM021 | Radiological Equipment | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective VI | 3 | 0 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective VII | 3 | 1 | 0 | 3 |
| GE | 15EBM… | Generic Elective IV | 3 | 0 | 0 | 3 |
| CORE | 15EBM022 | Digital Signal Image processing Laboratory | 0 | 0 | 3 | 2 |
| CORE | 15EBM023 | Diagnostic and Therapeutic Equipment Lab | 0 | 0 | 3 | 2 |
| CORE | 15EBM013 | Inplant training | 0 | 0 | 0 | 2 |
| | | **TOTAL** | **18** | **4** | **6** | **24** |

B.E. Biomedical Engineering
CURRICULUM

| Category | Code No. | Course | Hours/Week | | | Credits |
|---|---|---|---|---|---|---|
| | | | **L**ecture | **T**utorial | **P**ractical | |
| **SEMESTER VII** | | | | | | |
| CORE | 15EBM025 | Pattern Recognition and Neural Networks | 3 | 1 | 0 | 4 |
| CORE | 15EBM026 | Medical Informatics | 3 | 0 | 0 | 3 |
| CORE | 15EBM027 | Virtual Instrumentation Design For Medical Systems | 3 | 1 | 0 | 3 |
| CORE | 15EBM028 | Biomechanics | 3 | 1 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective VIII | 3 | 0 | 0 | 3 |
| DSE | 15EBM… | Discipline Specific Elective IX | 3 | 0 | 0 | 3 |
| GE | 15EBM… | Generic Elective V | 3 | 0 | 0 | 3 |
| CORE | 15EBM029 | Virtual Instrumentation Design For Medical Systems Lab | 0 | 0 | 3 | 2 |
| CORE | 15EBM020 | Medical Image Processing and Analysis Lab | 0 | 0 | 3 | 2 |
| CORE | 15EBM024 | Minor Project | **0** | **0** | **0** | **2** |
| | | | **21** | **3** | **6** | **28** |
| **SEMESTER VIII** | | | | | | |
| Category | Code No. | Course | Hours/Week | | | Credits |
| | | | **L**ecture | **T**utorial | **P**ractical | |
| CORE | 15EBM021 | Prosthetic Engineering | 3 | 0 | 0 | 3 |
| GE | 15EBM… | Generic Elective VI | 3 | 0 | 0 | 3 |
| CORE | 15EBM022 | Project Work | 0 | 0 | 21 | 12 |
| | | **TOTAL** | **6** | **0** | **21** | **18** |

B.E.Biomedical Engineering

CURRICULUM

List of Discipline Specific Elective Courses

| Code No. | Course |
|---|---|
| 15EBM101 | Analog and Digital IC's |
| 15EBM102 | Analog and Digital IC's Laboratory |
| 15EBM103 | Bio fluidics and Dynamics |
| 15EBM104 | Physiological Modeling |
| 15EBM105 | Telemedicine |
| 15EBM106 | Nano-Electronics |
| 15EBM107 | Hospital Management |
| 15EBM108 | Rehabilitation Engineering |
| 15EBM109 | Trouble Shooting of Medical Instruments |
| 15EBM110 | Advanced Medical Imaging Devices |
| 15EBM111 | Design and Development of Medical Devices |
| 15EBM112 | Bio MEM's and Nanotechnology |
| 15EBM113 | Human Assist Devices |
| 15EBM114 | Fiber optics and Lasers in Medicine |
| 15EBM115 | Neural Engineering |

## List Of Generic Elective Courses

(To be selected by other Departmental Students in the University)

| Code No. | Course |
|---|---|
| 15EBT151 | Computational Fluid dynamics analysis |
| 15EBT152 | Robotics and Automation in Medicine |
| 15EBT153 | Biophotonics |
| 15EBT154 | Electrophysiology for human system |
| 15EBT155 | Bioethics and Biosafety |
| 15EBT156 | Entrepreneurship Development |
| 15EBT157 | Regulatory aspects in Bioscience |
| 15EBT158 | Professional Ethics in Engineering |

## List of Skilled Enhancement Elective Courses

| Code No. | Course |
|---|---|
| 15NSS255 | NSS Paper I |
| 15GPD251 | Personality Development I |
| 15GPD252 | Personality Development II |
| 15GPD253 | Personality Development III |

# Syllabus
# Core Courses

**15GBE201 TECHNICAL ENGLISH 3 0 0 3**

**COURSE OBJECTIVE:**

- To develop listening skills for academic and professional purposes.
- To acquire the ability to speak effectively in English in real life situations.
- To inculcate reading habit and to develop effective reading skills.
- To improve their active and passive vocabulary.
- To write letters and reports effectively in formal and business situations.

**UNIT I General Vocabulary 9**

General Vocabulary – Changing words from one form to another, Nouns- Compound nouns, Pronouns - Relative pronouns, Demonstrative pronouns, Adjectives - Comparative adjectives, Verbs- Modal verbs, Linking verbs, Adverbs, Word Links – Connectives, Sequence words, introducing oneself, Interactive grammar exercises.

**UNIT II Listening Skills 9**

Listening Skills - Note Making and Note-Taking, Transformation of Sentences – Positive, Comparative, Superlative, Affirmative, Negative, Interrogative and Assertive, Formation of Questions. Information Transfer - Chart – Flow chart, Bar chart, Pie chart. Pair works, SAM sessions.

**UNIT III Creative Thinking and Speaking 9**

Creative thinking and speaking, Tenses – Present Tense – simple present, present continuous, present perfect, present perfect continuous, Past Tense - simple past, past continuous, past perfect, past perfect continuous, Future Tense -simple future, future continuous, future perfect, future perfect continuous, Autobiographical writing, JAM session.

**UNIT IV Reading Skills 9**

Reading Skills- Skimming and Scanning, Comprehension Passage Paragraph Writing – Descriptive paragraph, Argumentative paragraph, Persuasive paragraph, Demonstrative paragraph, Compare and contrast, Conversations.

**UNIT V Vocabulary and Situational Dialogues 9**

Vocabulary, Prefixes and Suffixes, Cause and Effect relationship, Clauses and Phrases, Super-ordinates and Hyponyms, Expressing Causal Relation, Article, Prepositions, Preposition phrases, Speaking about the future plans, Reading comprehensions, Situational dialogues.

**TOTAL: 45 Hours**

**Course Outcome:**

**To equip the students with the following skills:**

CO -1: To understand, enjoy and appreciate a wide range of texts representing Different cultures, ways of living etc.

CO-2: To be able to organize and structure thoughts in writing/speech.

CO-3: To use language and vocabulary appropriately in different context and social encounters.

CO-4: To create generation aptitudes (familiarity and exactness in talking, perusing and composing).

CO-5: To empower the utilization of word reference.

CO-7: To develop the communicative and literary skills.

CO-8: Development of study skills.

**TEXT BOOKS:**

1. Department of English, Anna University, Mindscapes, 'English for Technologists and Engineers', Orient Longman Pvt. Ltd, Chennai: 2012.
2. Department of Humanities and Social Sciences, Anna University, 'English for Engineers and Technologists' Combined Edition (Volumes 1 and 2), Chennai: Orient Longman Pvt. Ltd., 2006.

**REFERENCE BOOKS:**

1. N. LakshmanaPeruma, Technical English-I, Second Edition, Hitech Publishing company PVT. Ltd, 2009.
2. Sumant. S, 'Technical English', Second Edition, McGraw-Hill Education (India) Pvt.Ltd., 2008.
3. T.M. Farhathullah, "Communication Skills for Technical Students", Orient Blackswan Private Limited., 2008

**15GBE001 MATHEMATICS-I 3103**

**COURSE OBJECTIVE:**

- To develop the skills in the areas of Matrices, Three dimensional Analytical Geometry, Differential calculus, Functions of several Variables and Multiple Integrals. To serve as a pre-requisite mathematics course for post graduate courses, specialized studies and research.

**UNIT I Matrices 12**

Characteristic equation – Eigenvalues and eigenvectors of a real matrix – Properties – Cayley-Hamilton theorem (excluding proof) – Orthogonal transformation of a symmetric matrix to diagonal form – Quadratic form – Reduction of quadratic form to canonical form by orthogonal transformation.

**UNIT II Three Dimensional Analytical Geometry 12**

Equation of a sphere – Plane section of a sphere – Tangent Plane – Equation of a cone – Right circular cone – Equation of a cylinder – Right circular cylinder.

**UNIT III Differential Calculus 12**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolute as envelope of normals.

**UNIT IV Functions Of Several Variables 12**

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives – Differentiation of implicit functions – Jacobians – Taylor's expansion – Maxima and Minima – Method of Lagrange's multipliers.

**UNIT V Multiple Integrals 12**

Double integration – Cartesian and polar coordinates – Change of order of integration – Change of variables between Cartesian and polar coordinates – Triple integrals – Area as double integral

**TOTAL: 60 Hours**

**CourseOutcomes:**

CO1: To develop the use of matrix algebra techniques this is needed by engineers for practical applications.

CO2: Identify various types of matrices, add, subtract and multiply matrices, compute the rank of a matrix.

CO3: Solve system of equations and use matrices and determinants.

CO4: To make the student acquire sound knowledge of techniques in solving analytical geometry that model engineering problems.

CO5: To derive the Plane equation, structure equation of Right Circular Cone & Cylinder.

CO6: Understanding the ideas of differential calculus and facility in solving simple standard examples like radius of curvature , circle of curvature

CO7: Evolutes, Envelopes and their Normal.

CO8: To familiarize the student with functions of several variables. This is needed in many branchesof engineering.

CO9: To make the functions of maxima and minima values.

CO10:To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

**TEXT BOOKS:**

1. Grewal. B.S, "Higher Engineering Mathematics", KhannaPublications ,Delhi,43rd Edition, 2013.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi,6th reprint, 2008.

**REFERENCE BOOKS:**

1. Glyn James, "Advanced Modern Engineering Mathematics",Pearson Education ,3rd Edition, 2012.
2. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House ,4th Edition,2014

**15GBE002 ENGINEERING PHYSICS 3003**

**COURSE OBJECTIVE:**

- To learn the basics of Ultrasonics, Lasers, Fibre optics and applications, Quantum physics and crystal physics etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications.

**UNIT I Ultrasonics 9**

Introduction – Production – magnetostriction effect – magnetostriction generator – piezoelectric effect – piezoelectric generator – Detection of ultrasonic waves– properties – Cavitations – Velocity measurement – acoustic grating – Industrial applications – drilling, welding, soldering and cleaning –Non Destructive Testing – pulse echo system through transmission and reflection modes – A, B and C scan displays- SONAR – Medical applications – Sonograms.

**UNIT II Lasers 9**

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion, pumping - Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, $CO_2$ ,Nd-YAG, Semiconductor lasers homojunction and heterojunction (Qualitative) - Industrial Applications – Lasers in welding, heat treatment, cutting – Medical applications – Holography (construction and reconstruction).

**UNIT III Fiber Optics and Applications 9**

Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle – Types of optical fibres (material, refractive index, mode) – fibre manufacturing (Double crucible technique) – Splicing, Loss in optical fibre – attenuation, dispersion, bending – Fibre optical communication system (Block diagram) – Light sources – Detectors –PIN Photo diode- Fibre optic sensors – temperature and displacement – Endoscope.

**UNIT IV Quantum Physics 9**

Black body radiation – Planck's radiation law (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans Law from Planck's theory – Compton effect – Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box – Electron microscope - Scanning electron microscope – Transmission electron microscope.

**UNIT V Crystal Physics 9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – Polymorphism and allotropy – Crystal defects – point, line and surface defects – Burger vector.

**TOTAL: 45 HOURS**

**Course outcome:**

CO1: Discuss the production of ultrasonics by different methods and their medical applications.
CO2: Develop the types of lasers and find their applications.
CO3: Develop the fiber optic communication system and find their applications.
CO4: Relate the enhance knowledge about photonics and optical fiber communication system.
CO5: Explain the fundamentals of quantum mechanical concepts and describe the phenomenon of electron microscopes.
CO6: Illustrate the appropriate ways of solving quantum mechanical problems.
CO7: Understand the efficacy of quantum equations in modern areas.
CO8: Relate the crystallographic parameters and crystal growth techniques.
CO9: Relate the concept of lasers and crystal physics.
CO10: Apply the working knowledge of fundamental physics and basic engineering principles to include advanced knowledge in one or more engineering disciplines.

**TEXT BOOKS:**


1. Gaur, R. K. and Gupta, S.C., 'Engineering Physics' Dhanpat Rai Publications, New Delhi 2013.
2. Avadhanulu, M.N. and Kshirsagar, P.G., 'A Text book of Engineering Physics', S.Chand and Company, Ltd., New Delhi, 2013.


**REFERENCE BOOKS:**


1. Frank J.Faly, "Foundations of Engineering Accoustics", Elsevier Academic press, 2005.
2. Williams T.Silfrast, "Laser Fundamentals", Cambridge University press, 2004.
3. John Gowar, "Optical communication systems", Prentice Hall publications, 1993.
4. Murugesan R and Sivaprasath K, Modern Physics, S. Chand Ltd., 2008.


**15GBE003 FUNDAMENTALS OF COMPUTING 3003**

**COURSE OBJECTIVE:**

- To understand the concepts of Programming language - C and Html
- To learn the basics of C declarations, operators, expressions and html tags
- To learn on the manipulation of strings, functions and pointers

**UNIT I Introduction to Computers 9**

Introduction – Characteristics, Classification and Evolution of Computers – Computer Generations – Basic Computer organization – Number Systems – Computer Software – Types of Software – Software Development Steps.

**UNITII Problem Solving and Office Application Software 9**

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode – Application Software Packages – Introduction to Office Packages – Internet basics: Internet evolution, Html tags- Forms- Frames.

**UNIT III Introduction to C 9**

Overview of C: Constants, Variables, Keywords, Data Types – Compilation and Execution – Input and Output functions – Operators – C Instructions – Control Instructions : Decision control structure, Loop Control structure, Case Control Structure.

**UNIT IV Functions and Pointers 9**

Functions: Library functions, User defined functions, call by value, call by reference, recursive functions – Pointers – Arrays: one dimensional array, multi-dimensional array, arrays using pointers – Strings: library string functions – pointers in strings.

**UNIT V Structures and Files 9**

Structures – Unions – Storage classes – Dynamic memory allocation – Files: file Operations, Preprocessor directives – use of type def– Command line arguments.

**TOTAL: 45 Hours**

**Course Outcomes (COs)**

CO-1 : To understand the characteristics, classification and evolution of computers.

CO-2 : To learn the generation of computers and their architecture.

CO-3 : To be well versed in Numbers Systems and their conversions.

CO-4 : To determine the advantages and limitations of algorithm, flowchart and pseudocode.

CO-5 : To explain the features of application software packages and evolution of internet.

CO-6 : To develop programs using various control instructions and operator precedence in C programming.

CO-7 : To handle string manipulations, array and functions for various applications using C programming constructs.

CO-8 : To analyze the merits of pointers in C.

CO-9 : To understand the difference in memory allocation while using structure and union in C programming.

CO-10 :To learn the various file operations in C.

**TEXT BOOKS:**


1. YashavantKanetkar, "Let Us C", BPB Publications, Thirteenth Edition 2013.
2. Balagurusamy, E., "Computing fundamentals and C Programming", Tata McGraw-Hill Publishing Company Limited, 2010.
3. Thomno A. Powell, "The Complete Reference HTML and CSS", fifth edition, Tata McGrawHill, 2010.


**REFERENCE BOOKS:**


1. Ashok.N.Kamthane, "Computer Programming", Pearson Education (India) 2009.


**15GBE004 ENGINEERING GRAPHICS 1033**

**COURSE OBJECTIVE:**

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

**CONCEPTS AND CONVENTIONS (Not for Examination)**

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 12**

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 12**

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

**UNIT III Projection of Solids 12**

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 12**

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 12**

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.

**COMPUTER AIDED DRAFTING (**Demonstration Only**)**

Introduction to drafting packages and demonstration of their use.

**TOTAL: 60 Hours**

**TEXT BOOK:**


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


**REFERENCE BOOKS:**


1. Gopalakrishna K.R., "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. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.
4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New AgeInternational (P) Limited, 2008.
5. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
6. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing CompanyLimited, 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

**15GBE005 ENGINEERING PRACTICES LABORATORY 0032**

**GROUP A – MECHANICAL AND CIVIL ENGINEERING PRACTICES**
**MECHANICAL ENGINEERING PRACTICES**

**COURSE OBJECTIVE:**

- To study bench fitting drawings for making male and female fittings as per the given dimensions and Tolerances.
- To study Arc welding drawings for making common weld joints as per the given dimensions.
- To study sheet metal development drawings for making common metal parts/components as per the given dimensions.

**LIST OF EXPERIMENTS**

1. To make square, hexagonal, V joint in bench fitting as per the given dimensions and Tolerances.
2. To make single V, butt, lap and T fillet joint by arc welding with the back hand and fore hand welding techniques as per the given dimensions.
3. To make simple Cubical blocks, Rectangular trays in sheet metal with the jigs as per the given dimensions.

**15GBE006 ENGINEERING PHYSICS LABORATORY 0 0 3 2**

**Physics Laboratory**

**List of Experiments**

1. Determination of Young's modulus of the material – Non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
4. Determination of viscosity of liquid – Poiseuille's method.
5. Spectrometer – Dispersive power of a prism.
6. Determination of Young's modulus of the material – Uniform bending.
7. Torsional Pendulum – Determination of Rigidity modulus.
8. Ultrasonic Interferometer – Velocity of ultrasonic waves and compressibility of liquids.
9. Spectrometer – Grating – Wavelength of mercury spectrum.
10. Determination of wavelength of LASER and particle size using Grating.

**15GBE007 COMPUTER PRACTICE LABORATORY 0032**

**COURSE OBJECTIVE:**

The student should be made to:

- Be familiar with the use of Office software.
- Be exposed to presentation and visualization tools.
- Be exposed to problem solving techniques and flow charts.
- Be familiar with programming in C.
- Learn to use Arrays, strings, functions, structures and unions.

**A)WORD PROCESSING**

1. Document creation, Text manipulation with Scientific notations.
2. Table creation, Table formatting and Conversion.
3. Mail merge and Letter preparation.
4. Drawing - flow Chart.

**B) SPREAD SHEET**

1. Chart - Line, XY, Bar and Pie.
2. Formula - formula editor.
3. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
4. Sorting and Import / Export features.

**C) POWERPOINT**

1. Any presentation of minimum five slides.

**D) SIMPLE C PROGRAMMING ***

1. Data types, Expression Evaluation, Condition Statements.
2. Arrays.
3. Structures and Unions.
4. Functions and Pointers.
5. File Operations.

**E) HTML PROGRAMMING***

1. Create a webpage to embed an image in that page using HTML tags.
2. HTML program for Table creation.

**Course Outcome :**

CO-1 : To create and manipulate various operations in word document using MS-Office.

CO-2 : To design and perform various operations in tables.

CO-3 : To generate letters using Mail-Merge.

CO-4 : To implement various editing and formatting operations in spread sheet.

CO-5 : To create power point presentation slides.

CO-6 : To develop programs using various control instructions and operator precedence in C Programming.

CO-7: To implement string manipulations, arrays and functions for various applications in C.

CO-8 : To analyze the use of structures, unions and pointers in C.

CO-9 :To handle various file operations in C.

CO-10 :To design web pages using HTML Tags.

**15GBE008 MATHEMATICS-II 3104**

**COURSE OBJECTIVE:**

- To acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To learn 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 understand 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 Ordinary Differential Equations 12**

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

**UNIT II Vector Calculus 12**

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

**UNIT III Analytic Functions 12**

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

**UNIT IV Complex Integration 12**

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

**UNIT V Laplace Transform 12**

Laplace transform – Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse functions – Transform of periodic functions.Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

**TOTAL: 60 Hours**

**Course Outcomes:**

CO1: To make the student acquire sound knowledge of techniques in solving ordinary differentialequations that model engineering problems.

CO2:To have an ability of mathematical modeling of systems using differential equations and ability to solve the differential equations.

CO3: To acquaint the student with the concepts of vector calculus needed for problems in all engineering disciplines.

CO4:To use Stokes' theorem, Green's theorem and Gauss divergence an to give a physical interpretation of the curl of a vector field.

CO5:To introduce the basics of analytic functions and the basics in complex integration this is used to evaluate complicated real integrals.

CO6:Evaluate real and complex integrals using the Cauchy integral formula and the residue Theorem.

CO7:To use shift theorems to compute the Laplace transform, inverse Laplace transform and the solutions of second order, linear equations with constant coefficients.

CO8:To introduce the concepts of Laplace Transforms and its applications to various

problems related to engineering and technology.

CO9:To be able to find time responses of linear systems using Laplace transforms.

CO10:To apply partial fraction expansion to simplify a transform function for inverse Laplace transformation.

CO11:To apply Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs.

**TEXT BOOKS:**


1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications ,Delhi,43rd Edition, 2013.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi,6th reprint, 2008.


**REFERENCE BOOKS:**


1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education ,3rd Edition, 2012.
3. Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House ,4th Edition,2014


**15GBE009 ENGINEERING CHEMISTRY 3103**

**COURSE OBJECTIVE:**

- To learn the basics of chemistry and application of water technology, principles of electrochemistry, nuclear chemistry, nano chemistry, engineering materials, polymer and composites, corrosion and storage devices etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications.

**UNIT I Water Technology 9**

Characteristics – alkalinity – types of alkalinity and determination – hardness – types of estimation by EDTA method (problem) – Domestic water treatment – disinfection methods (Chlorination, ozonation. UV treatment) – Boiler feed water – requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – de mineralization process – desalination and reverse osmosis.

**UNIT II Electrochemistry, Nuclear Chemistry and Nano Chemistry 9**

Introduction -Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode – Calomel electrode – Ion selective electrode – glass electrode and measurement of pH - Nuclear energy – fission and fusion reactions and light water

nuclear reactor for power generator (block diagram only) – Breeder reactor.Nanomaterials – introduction to nanochemistry – carbon nanotubes and their applications.

**UNIT III Engineering Materials 9**

Refractories – classification – acidic, basic and neutral refractories – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) – manufacture of alumina, magnesite and zirconia bricks and their applications. Abrasives – natural and synthetic abrasives – quartz, corundum, emery, garnet, diamond, silicon carbide and boron carbide. Lubricants – mechanism of lubrications – properties – viscosity index – flash and fire points, cloud and pour points – oiliness – solid lubricants – graphite and molybdenum di sulphide.

**UNIT IV Polymers and Composites 9**

Polymers – definition – polymerization – types – addition and condensation polymerization – free radical polymerization and mechanism – Plastics, classification – preparation, properties and uses of PVC, Teflon, polycarbonate, polyurethane, nylon-6,6, PET – Rubber – vulcanization of rubber. Synthetic rubbers. Composites – definition, types, polymer matrix composites – FRP onlyConducting polymers, semiconducting polymers, molecular switches—examples, mechanism and applications.

**UNIT V Corrosion, Corrosion Control and Storage Devices 9**

chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – factors influencing corrosion – corrosion control – sacrificial anode and impressed cathodic current methods – corrosion inhibitors – protective coatings – paints – constituents and functions – metallic coatings – electroplating (Au) and electroless (Ni) plating. Solar energy conversion – solar cells – wind energy – fuel cells –hydrogen – oxygen fuel cell – Batteries – alkaline batteries – lead – acid batteries – nickel – cadmium batteries and lithium batteries.

**TOTAL: 45 Hours**

**Course outcome:**

After studying this topic, students will be able to

**1:** To know aboutcharacteristics of water and estimation of hardness using EDTA Titration

**2:** Determinealkalinity and its types of alkalinity using neutralisation reaction

**3:** Explain different types of Nuclear reactions, stability of Nucleus and Nuclear forces

**4:** Distinguish between Daniel cell, Voltaic cell, batteries etc.

**5:** Define refractories, abrasives, lubricants and its classifications.

**6:**.Define polymers, Classifications of polymers and its synthetic applications.

**7:** Distinguish between Chemical and Electrochemical Corrosion and method of prevention

**8:** Gain knowledge aboutdifferent sources of energy and types of batteries

**9:** Understand the method of synthesis and different types of Nanotubes and its application

**TEXT BOOKS:**

1. B.Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi

2008.
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut 2001.
3. Puri and Sharma "A text book of Physical chemistry ", Chand and Co., New Delhi

**REFERENCE BOOKS:**

**1.** Jain P.C. and Monica Jain, "Engineering Chemistry", Dhanpat Rai publishing Company (P) Ltd., New Delhi, 2010
2. Dara S.S, Umare S.S, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010

**15GBE010 MATERIALS SCIENCE 3003**

**COURSE OBJECTIVE:**

To learn the basics of conducting materials, semiconducting materials, magnetic super conducting materials, Dielectric materials and Modern Engineering Materials etc., and to apply these fundamental principles to solve practical problems related to materials used for engineering applications

**UNIT I Conducting Materials 9**

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

**UNIT II Semiconducting Materials 9**

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

**UNIT III Magnetic and Superconducting Materials 9**

Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites, applications – magnetic recording and readout, storage of magnetic data, tapes, floppy and magnetic disc drives. Superconductivity - properties – Types of superconductors – BCS theory of superconductivity(Qualitative) – High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

**UNIT IV Dielectric Materials 9**

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

**UNIT V Modern Engineering Materials 9**

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties, application, advantages and disadvantages of SMA. Nanomaterials: synthesis – plasma arcing – chemical vapour deposition – sol-gels – electrodeposition – ball milling – properties of nanoparticles and applications, Carbon nanotubes: fabrication.

**TOTAL: 45 Hours**

Course outcome:

CO1: Discuss the classical free electron theories of conducting materials.
CO2: Explain the theoretical aspects of semiconducting materials and illustrate the correct and efficient ways of solving problems.
CO3: Compare the types of magnetic and superconducting materials and their applications.
CO4 : Discuss the various types of polarization mechanisms in dielectrics and illustrate the applications of dielectric materials.
CO5: Identify new engineering materials for design and construction.
CO6: Develop the applications of prepared advanced engineering materials.
CO7: Understand the contemporary issues relevant to Materials Science and Engineering.
CO8: Apply general mathematics, science and engineering skills to the solution of engineering problems.
CO9: Apply core concepts in Materials Science to solve engineering problems.
CO10 : Use the techniques, skills and modern engineering tools necessary for engineering practice.

**TEXT BOOKS:**


1. Rajendran, V, and Marikani A, 'Materials Science' Tata McGraw Hill publications, New Delhi 2011.
2. Vijaya, M. and Rangarajan G, 'Materials Science' Tata McGraw Hill publications, New Delhi 2006.


**REFERENCE BOOKS:**


1. Charles Kittel 'Introduction to Solid State Physics', John Wiley and sons, 7th edition, Singapore 2008.
2. Kasap S.O, "Principles of Electronic Materials", 3rd edition, McGrawHill Higher Education, 2005.
3. Pradeep T, "A text book of Nanoscience and Nano technology, McGrawHill Higher Education, 2012.
4. Palanisamy P.K, 'Materials Science', Scitech publications, Chennai, 2007.

**15EBM001 HUMAN PHYSIOLOGY 3003**

**COURSE OBJECTIVE**

To give an idea to thestudent about various mechanisms involved in the normal functioning of human body, underlining the basic working principles of different biological processes with engineering tools.

**UNIT-I GENERAL PHYSIOLOGY 12**

Evolutionary aspects of biological systems, Thermodynamics of biological systems, Digital and analog molecules, Patterning of activity, Active and Passive process, Molecular homeostasis(molecular plasticity),Endogenous feed forward circuitry, Development and consolidation, stratified stabilities, Homogenous and Heterogeneous integration of Bio-molecules, Organelles, Integration of Organelles, Cells, Membrane Physiology, Transport across cell membrane, genesis of membrane potentials, Nernst equation, Resting membrane potential, Goldmann-Hodgkin-Katz equation, Cable properties (Local signaling-Analog Potentials(Digital mode),Hodgkin-Huxley model, Differential equations of action potentials, Voltage-Clamp and Patch-clamp methods, Signal Processing-Synapse, signal Transduction, Neuro transmitters, Biological amplification and filtration, Signal Integration(Input-sensory), Centers of Integration-Spinal Cord, Brain Stem, Cerebral Cortex, Motor System(Output)-Organization-Cortical, Sub cortical and spinal, Reflex process, NMJ, Smooth muscle, Cardiac Muscle, Skeletal muscle, Excitation-Contraction coupling, Sarcomere-Contractile Unit, Motor Unit, Frequency and Intensity related summation(temporal and Multi motor unit Summation),Tetanus, Load, Fatigue, EMG.

**UNIT-II CARDIOVASCULAR SYSTEM 12**

Conducting system of the Heart, ECG, Blood as Non-Newtonian fluid, Dynamics of peripheral circulation, Resistance and Impedance, Streamline and Turbulent flow, Raynold's Number, Poisulle equation, Bernoulli equation, B.P., Control systems- Neurohumoral regulation, applied aspects.

**UNIT-III RESPIRATORY SYSTEM 12**

Biophysics of Transport Across Respiratory Membrane, Perfusion and Diffusion limited process, Ventilation, Alveolar, Shunt and Dead space equations, Ventilation-perfusion inequalities, Physiological and anatomical shunts and dead spaces, Biophysics of transport of gasses in the blood, hemoglobin-oxygen association and dissociation curve, Haldane and Bohr effect, Applied aspects, Ventilators.

**UNIT-IV RENAL SYSTEM 12**

Regulation of volume and composition of Body fluids, Clearance equations, Biophysics of Filtration, Re-absorption and secretion, Counter current Multiplication and Exchange, Acid-Base Balance, regulation of Body Temperature-Physical and Physiological process, applied aspects, Dialysis, etc. Hormonal regulation of Body functions, Overview of Reproductive Physiology.

**UNIT-V NERVOUS SYSTEM 12**

Higher functions of Brain(Perception, Rule of special senses, Learning and memory),Cybernetics of living systems, Neuro-Endocrine Control System, Servo mechanism, Posture and equilibrium, Motor skills, Neural Network related to the cognitive functions of the brain, near field(EEG) and Far Field Potentials(Evoked Potentials).

**TOTAL: 45 Hours**

**COURSE OUTCOME:**

The students will be able to:

CO1: Attain deeper knowledge of the physiological system of the body
CO2: Learn about the conducting system of heart
CO3: Understand the molecular level knowledge about the physiological systems
CO4: Apply the respiratory system knowledge to understand ventilator need and functions
CO5: Understand the role of kidney in regulation of body fluids and wastes
CO6: Identify the needs of dialysis and its application

**TEXTBOOKS:**

1. Mount Castle, Textbook of Medical Physiology.
2. Best and Taylor, Physiological basis of Medical Practice.
3. John.Herbert Green, An Introduction to physiology, Oxford University Press, 1976
4. Gillain pocock, Christopher D.Richards, Human Physiology, The Basis of Medicine, Oxford University Press, 2004

**REFERENCES:**

1. Lauralee Sherwood, Hillar Klandorf, Paul H. Yancey, Textbook of Animal Physiology, Cenage Learning, 2008.

**15EBM002 BIOCHEMISTRY 3103**

**Course Objective:** To develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of biomolecules and their deviation from normal and their consequences for interpreting and solving clinical problems.

**UNIT - I BIOCHEMICAL ORGANIZATION AND BIOENERGETICS 15**

Scope of clinical biochemistry, component of the cell, structure and biochemical functions, membrane structure and functions, transport through biological cell membrane, the concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics and biological oxidation – general concept of oxidation and reduction, electron transport chain, oxidative phosphorylation, uncouplers and theories of biological oxidation and oxidative phosphorylation

**UNIT - II BIOMOLECULES 15**

**Carbohydrates** – classification, properties.starch, glycogen, dextrin, inulin, cellulose, metabolism of carbohydrates – gluconeogenesis, glycogenolysis, glycolysis.citric acid cycle and its biological significance, role of sugar in nucleotide biosynthesis and pentose phosphate pathway. **Lipids** – Classification, properties. sterols, essential fatty acids, eicosanoids, phospholipids, sphingolipids, metabolism of lipids, oxidation of fatty acids, α,β - oxidation and biosynthesis of ketone bodies, cholesterol, porphyrin biosynthesis, metabolism of bile

pigments. **Proteins and amino acids** – Classification, properties, biosynthesis of amino acids and proteins, essential amino acids, metabolism of amino acids and proteins, Nitrogen balance. **Nucleic acids** –genetic code, nucleic acids, and structure of DNA and RNA, purine biosynthesis and pyrimidine biosynthesis.

**UNIT - III BIOENERGETICS 5**

High energy compounds , electronegative potential of compounds , respiratory chain , ATP cycle, Calculation of ATP during oxidation of glucose and fatty acids.

**UNIT - IV MACROMOLECULES, VITAMINS, HORMONES, ENZYMES 15**

Physical and chemical properties, structure of hemoglobin, immunoglobulin and nucleoprotein, classification and their properties, occurrence, functions, requirements, deficiency manifestations and role of vitamins as coenzyme, chemical nature and properties, hormones, Nomenclature, enzyme kinetics, classification and their properties, mechanism of action, enzyme induction and inhibition, coenzyme significance and enzymes of clinical importance.

**UNIT -V BIOCHEMISTRY OF CLINICAL DISEASES 10**

Diabetes mellitus, atherosclerosis, fatty liver, and obesity, hormonal disorders, aging, inborn errors of metabolism organ function tests

**TOTAL: 45 L + 15T = 60 HOURS**

**Course Outcome:**

CO1: Students will explain/describe the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways along with their regulation at the epigenetic, transcriptional, translational, and post-translational levels including RNA and protein folding, modification, and degradation. Regulation by non-coding RNAs will be tied to the developmental and physiological functioning of the organism.

CO2: Students will analyze structural-functional relationships of genes and proteins from bacteria to eukaryotes using genomic methods based on evolutionary relationships.

CO3: Students will use current biochemical and molecular techniques to plan and carry out experiments. They will generate and test hypotheses, analyze data using statistical methods where appropriate, and appreciate the limitations of conclusions drawn from experimental data.

CO4: Students will analyze the pathological conditions like obesity, Diabetes mellitus, atherosclerosis, fatty liver, and hormonal disorders, aging.

CO5: Students will be able to understand and compare the Physical and chemical properties and structure of haemoglobin, immunoglobulins and nucleo protein.

CO6: Students will be able to identify the High energy compounds , electronegative potential of compounds , respiratory chain , ATP cycle and Calculation of ATP during oxidation of glucose and fatty acids

**TEXTBOOKS:**


1. Lehninger A.L., Nelson D.L. and Cox M.M. Principles of Biochemistry. CBS publishers and distributers
2. Murray R.K., Granner D.K., Mayes P.A. and Rodwell V.W. Harpers Biochemistry. Appleton and Lange, Stanford, Conneticut.
3. Thomas M. Devlin. Textbook of Biochemistry with clinical correlations. Wiley Liss Publishers

**REFERENCES:**


1. Burtis & Ashwood W.B. Tietz Textbook of Clinical Chemistry, Saunders Company
2. Lubert Stryer W.H. Biochemistry. Freeman and company, New York.
3. Donald Voet& Judith G. Voet. Biochemistry. John Wiley and Sons, Inc.
4. Rama Rao Textbook of Biochemistry.
5. Deb. Textbook of Biochemistry.


**15GBE011ENGINEERING CHEMISTRY LABORATORY 0032**

**COURSE OBJECTIVE:**

- To acquire practical skills in the determination of water quality parameters through volumetric analysis.
- To determine the molecular weight of a polymer by viscometry.

**LIST OF EXPERIMENTS**

1. Determine the total, permanent and temporary hardness of the given water sample by EDTA method. A standard hard water and EDTA solutions are provided.
2. Determine the type and amount of alkalinity present in the given water sample. A standard solution of sodium hydroxide of strength 0.1N is given.
3. Estimate the amount of chloride present in the water sample by Argentometric analysis. A standard solution of strength 0.01N and sodium chloride solutions are provided
4. Determination of molecular weight of given polymer solution by Ostwald viscometer method.
5. Determine the amount of strong acid and weak acid (HCl and CH3COOH) present in 1 litre of the given mixture of acid solution by conducto-metric titration using standard NaOH of normality 0.2N.
6. Determine the amount of barium chloride present in 1 litre of the given solution by conductometric titration using standard solution of sodium sulphate of normality 0.2N.
7. Estimate the amount of ferrous ion present in the whole of the given solution. A standard solution of potassium dichromate of strength 0.1N is provided.
8. Determine the strength of the given hydrochloric acid by pH-metry with 0.2N sodium hydroxide solution.

**15EBM003 HUMAN PHYSIOLOGY AND BIOCHEMISTRY LABORATORY 0032**

**Course Objective:** To provide practice in estimation and quantification of biomolecules, separation of macromolecules and their clinical importance. Study of the different physiological parameters and their clinical abnormalities.

**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 creatine
5. Estimation of urea
6. Estimation of cholesterol
7. Assay of SGOT/SGPT
8. Separation of proteins by SDS electrophoresis
9. ESR, PCV, MCH, MC, MCHC, total count of RBCs and hemoglobin estimation.
10. Test of vision:

a) Acuity of vision b) Colour vision, c) Ophthalmoscopy, d)Error of refraction

11. Examination of sensory system.
12. Examination of motor system. Recording of action potential and its display on oscilloscope (Demonstration).

**LAB REQUIREMENT FOR A BATCH OF 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
- 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 1 box
- Ophthalmoscope (direct & Indirect) 1 No
- Blood grouping kit 1 No

**TOTAL: 45 HOURS**

**Course Outcome:**

CO1: List the laboratory tests performed for analysis of carbohydrates, proteins and lipids.
CO2: Estimates the presence of blood glucose, urea, creatinine and cholesterol.
CO3: Practical knowledge about the preparation of serum and plasma from blood.
CO4: Explains about the assays SGOT / SGPT and protein separation by electrophoresis.
CO5: Practical examination of hemoglobin count and RBC measurements.
CO6: Describes the test for vision including errors of refraction.
CO7: Explains the examination procedure of sensory and motor system.

## SEMESTER III

### 15GBE204 ENVIRONMENTAL SCIENCE AND ENGINEERING 3 0 0 3

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

**UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 9**

Definition – Scope and importance – Need for public awareness – Concepts 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 – Bio geographical 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 and Birds. Field study of simple ecosystems - pond, river, hill slopes, etc.

**UNIT II ENVIRONMENTAL POLLUTION 9**

Definition – Causes, Effects and Control Measures of (A) Air Pollution (B) Water Pollution (C) Soil Pollution (D) Marine Pollution (E) Noise Pollution (F) Thermal Pollution (G) Nuclear Hazards – Solid Waste Management:- Causes, Effects and Control Measures of municipal solid Wastes – Role of an Individual in Prevention of Pollution – Pollution Case Studies – disaster Management - Floods, Earthquake, Cyclone and Landslides-Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

**UNIT III NATURAL RESOURCES 9**

Forest resources -Use and over – Exploitation – Deforestation – Case studies – Timber extraction –Mining – Dams and their 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 9**

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 9**

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.

**COURSE OUTCOME**

CO-1:To understand the nature and facts about environment.
CO-2: To find and implement scientific, technological, economic solutions to environmental problems.
CO-3: To know about the interrelationship between living organisms and environment.
CO-4: To understand the integrated themes and biodiversity, natural resources, pollution control and waste management.
CO-5: To appreciate the importance of environment by assessing its impact on the human world.
CO-6: To study the dynamic processes and understand the features of the earth's interior and surface.
CO-7: To know about what is the role of an individual in Conservation of Natural Resources.
CO-8: To know about the various social issues.
CO-9: To understand the role of government in solving the environmental problems.
CO-10: To know about Population Growth and variation among Nations

**TOTAL: 45 HOURS**

**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.

**REFERENCES BOOKS:**

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol.I and II, Enviro Media.Cunningham
2. 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.

**15GBE012 MATHEMATICS-III 3 1 0 3**

**COURSE OBJECTIVE:** To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems? The understanding of the mathematical principles on Fourier series and transforms, partial differential equations and Z transform would provide them the ability to formulate and solve some of the physical problems of engineering.

**UNIT I FOURIER SERIES 12**

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

**UNITII FOURIER TRANSFORM 12**

Fourier integral theorem (without proof) – Fourier transform pair –Fourier Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

**UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12**

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

**UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12**

Classification PDE-Method of separation of variables - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional heat equation (excluding Insulated edges) .

**UNIT V Z -TRANSFORM AND DIFFERENCE EQUATIONS 12**

Z-transform - Elementary properties – Inverse Z-transform(using partial fraction and residues) – Convolution theorem - Formation of difference equations – Solution of difference equations using Z- transform.

**TOTAL: 60 HOURS**

**Course Outcome:**

CO1: To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
CO2: The Fourier series and its resulting Fourier analysis is used in electronics engineering to analyse waveforms and process them in a process known as digital signal processing (DSP).
CO3: To develop Fourier series for different types of functions.
CO4: To acquaint the student with Fourier transform techniques used in wide variety of situations.
CO5: Define and determine Fourier Transform.
CO6: Introduce students to how to solve linear Partial Differential with different methods.
CO7: Describe and implement the various standard methods for the solution of PDE.
CO8: The understanding of the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
CO9: Derive and obtain the solution of wave, heat equation and boundary value problems.
CO10: Define Z -Transform and obtain the solution of difference equations.
CO11: To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z- transform techniques for discrete time systems

**TEXT BOOKS:**

1. Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications ,Delhi,43rd Edition, 2014.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 6 th reprint,2008.

**REFERENCE BOOKS:**

1. Bali.N.P. and Manish Goyal 'A Textbook of Engineering Mathematics', Laxmi Publications, 9th edition,2011.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, 9th Edition, 2011.
3. Glyn James, "Advanced Modern Engineering Mathematics",Pearson Education ,4th Edition, 2011.
4. Sivaramakrishna Das.P& Vijayakumari.C ,A Text book of Engineering Mathematics-III (Transforms & Partial Differential equations), Pearson Eduaction Limited ,5th Edition ,2013.

**15EBM004 PATHOLOGY AND MICROBIOLOGY 3103**

**Course Objective:** To help the studentGain a knowledge on the structural and functional aspects of living organisms, know the etiology and remedy in treating the pathological diseases and empower them with knowledge of the importance of public health.

**UNIT-I CELL DEGENERATION, REPAIR AND NEOPLASIA 12**

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 12**

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

**UNIT-III MICROSCOPES 12**

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 12**

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 12**

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

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1:List the laboratory tests performed for urine analysis.
CO2:Staining procedures are explained completely for the identification of microorganisms.
CO3: Practical knowledge about microscopes.
CO4: Explains the bleeding and clotting time for analysis of the fluid in the body.
CO5: Practical description about the structure and organisation of microorganisms and pathogens.
CO6: Microscopic visualisation of the microorganisms for disease determination.
CO7: Practical explanation of techniques used in tissue processing

**TEXT BOOKS:**

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins, “Pathologic Basis of Diseases”, 7th edition, WB Saunders Co. 2005 (Units I & II).
2. Prescott, Harley and Klein, “Microbiology”, 5th edition, McGraw Hill, 2002 (Units III, IV & V).

**REFERENCES:**

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone, 3rd edition, 2000.
2. Ananthanarayanan & Panicker, “Microbiology” Orientblackswan, 2005.
3. Dubey RC and Maheswari DK. “A Text Book of Microbiology” Chand & Company Ltd, 2007.

**15EBM005 BIOMATERIALS AND ARTIFICIAL ORGANS 3003**

**Course Objective:** The student should be made to learn characteristics and classification of Biomaterials, Understand different metals and ceramics used as biomaterials, learn polymeric materials and combinations that could be used as a tissue replacement implants and know artificial organ developed using these materials.

**UNIT - I STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY 12**

Definition and classification of bio-materials, mechanical properties, visco elasticity, wound healing process, body response to implants, blood compatibility.

**UNIT-II IMPLANTMATERIALS 12**

Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications.

**UNIT- III POLYMERIC IMPLANT MATERIALS 12**

Polymerization, polyamides, Acryrilic polymers, rubbers, high strength Thermoplastics, medical applications. Bio polymers: Collagen and Elastin. Medical Textiles: Silica, Chitosan, PLA composites, Sutures, wound dressings. Materials for ophthalmology: contact lens, Intraocular lens. Membranes for plasma separation and Blood oxygenation.

**UNIT- IV TISSUE REPLACEMENT IMPLANTS 12**

Small intestinal submucosa and other decullarized matrix biomaterials for tissue repair. Softtissue replacements, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, Pancreas replacement.

**UNIT - V ARTIFICIAL ORGANS 12**

Artificial blood, Artificial skin, Artificial Heart, Prosthetic Cardiac Valves, Artificial lung (oxygenator), Artificial Kidney (Dialyser membrane), Dental Implants.

**TOTAL: 45 HOURS**

**Course Outcome:**

The students will :

CO1: Have deep knowledge regarding the various biomaterials used in healthcare industry
CO2: Understand biocompatibility and the properties and classification of different types of Biomaterials
CO3: Learn about the role of biomaterials in several assist devices
CO4: Understand basic biomaterials used for manufacturing prosthetic devices
CO5: Acquire knowledge about medical textiles and their need in healthcare industry
CO6: Learn about tissue and organ replacements manufactured by these biomaterials

**TEXT BOOK:**

1. Sujata V. Bhatt, “Biomaterials”, Second Edition, Narosa Publishing House, 2005.

**REFERENCES:**

1. Park J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
2. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design" Mc Graw Hill, 2003

**15EBM006 BIOCONTROL SYSTEM 3 1 0 3**

**COURSE OBJECTIVES:**

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

**UNIT I CONTROL SYSTEM MODELLING 9**

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

**UNIT II RESPONSE ANALYSIS 9**

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

**UNIT III FREQUENCY RESPONSE ANALYSIS 9**

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

**UNIT IV PHYSIOLOGICAL CONTROL SYSTEMS 9**

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

**UNIT V PHYSIOLOGICAL SYSTEM MODELING 9**

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

**TOTAL= 45L + 15T= 60 HOURS**

**COURSE OUTCOME:**

The student will understand the fundamentals of (feedback) control systems :
CO1: The students will use models of physical systems in forms suitable for use in the

analysis and design of control systems.

CO2: The students will be able to solve system equations in state-variable form (state variable models).

CO3: The students will be able to solve the time and frequency-domain responses of first and second-order systems to step and sinusoidal (and to some extent, ramp) inputs.

CO4: The students will be able to determine the (absolute) stability of a closed-loop control system

CO5: The students will apply the root-locus technique to analyze and design control systems.

CO6: The students will be able to analyse the stability of the system, using routh Hurwitz algorithm.

CO7: The students will be able to understand the basics of physiological control system and basics to simulations.

CO8: The students will be able to understand and develop the physiological modelling of biosystems.

**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

**15EBM007 PATHOLOGY AND MICROBIOLOGY LABORATORY 0032**

**Course Objective:** The student should learn how to use Compound microscope, Practice on chemical examinations, Cryoprocessing, Histopathological examinations etc

**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 HOURS**

**LAB EQUIPMENTS FOR 30 STUDENTS:**

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

**Course Outcomes:**

CO1: List the laboratory tests performed for urine analysis.
CO2: Staining procedures are explained completely for the identification of microorganisms.
CO3: Practical knowledge about microscopes.
CO4: Explains the bleeding and clotting time for analysis of the fluid in the body.
CO5: Practical description about the structure and organisation of microorganisms and pathogens.
CO6: Microscopic visualisation of the microorganisms for disease determination.
CO7: Practical explanation of techniques used in tissue processing

## SEMESTER IV

**15GBE016 NUMERICAL METHODS 3 1 0 3**

**COURSE OBJECTIVE**: This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

**UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12**

Solution of algebraic and transcendental equations –Fixed point iteration method – Newton Raphson method – Solution of linear system of equations- Gauss elimination method – pivoting- Gauss-Jordon method– Iterative methods of Gauss Jacobi and Gauss-Seidel - Matrix Inversion by Gauss Jordon method – Eigen value of a matrix by power method .

**UNIT II INTERPOLATION AND APPROXIMATION 12**

Interpolation with unequal intervals- Lagrange's interpolation – Newton's Divided difference interpolation –cubic splines – Interpolation with equal intervals- Newton's forward and backward difference formulae.

**UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12**

Approximation of derivatives using interpolation polynomials- Numerical integration using trapezoidal and Simpson's 1/3 rule – Romberg's method – Two point and Three point Gaussian quadrature formulae – Evaluation of double integrals by trapezoidal and Simpsons's 1/3 rules.

**UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12**

Single step methods: Taylor series method – Euler's method-Modified Euler's method– Fourth order Runge – Kutta method for solving first order equations – Multistep methods-Milne's and Adam's Bashforth predictor and corrector methods for solving first order equations.

**UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12**

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain- One dimensional heat flow equation by explicit and implicit(crank Nicholson) methods – One dimensional wave equation by explicit method.

**TOTAL: 60 HOURS**

**Course Outcome:**

CO1: Understand discrete mathematical preliminaries.
CO2: Apply statistical and numerical methods in various computer science related projects, seminars and research.
CO3: Apply the knowledge of iterative methods to solve algebraic and transcendental equations, simultaneous linear equations, ODE (ordinary differential equations).
CO4: Acquire knowledge of finite differences, interpolation, numerical differentiation and numerical integration.
CO5: The nature of uncertainty and the concept of probability.
C06: Numerical techniques for solving first-order differential equations.
CO7: The student should recognize and understand the methodologies of various numerical techniques and associated error estimation analyses.
CO8 : Understand the concepts of probability and statistical methods.
CO9: Apply probability and statistical methods in the civil engineering problems.
CO10: Solve civil engineering problems using numerical methods.
CO11: Use computational soft tools

**TEXT BOOKS:**

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2012.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", 7 th Edition, Pearson Education, Asia, New Delhi, 2006.

**REFERENCE BOOKS:**

1. Chapra, S. C and Canale, R. P., "Numerical Methods for Engineers", Tata McGraw-Hill, New Delhi, 5th Edition, 2007.
2. Sankara Rao K, "Numerical Methods for Scientisits and Engineers", Printice Hall of India, New Delhi, 3rd Edition, 2007.
3. Sivaramakrishna Das.P and Vijayakumari.C,,"Numerical Analysis", Pearson Education Limited, South Asia, 8th Edition,2014

**15EBM008 MEDICAL PHYSICS 3103**

**Course Objective:** To study effects of sound and light in human body, effects of radiation in matter and how isotopes are produced.

**UNIT- I NON IONIZING RADIATION AND ITS MEDICAL APPLICATION 12**

Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light, Measurement of light and its unit- limits of vision and color vision an overview, Thermography– Application.

**UNIT- II SOUND IN MEDICINE 12**

Physics of sound, Normal sound levels –ultrasound fundamentals – Generation of ultrasound(Ultrasound Transducer) - Interaction of Ultrasound with matter; Cavitations, Reflection, Transmission- Scanning systems – Artefacts- Ultrasound- Doppler-Double Doppler shift-Clinical Applications.

**UNIT- III PRINCIPLES OF RADIOACTIVE NUCLIDES 12**

Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity. Radionuclide used in Medicine and Technology ,Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radio- nuclide-fission and electron Capture reaction, radionuclide Generator-Technetium generator.

**UNIT- IV INTERACTION OF RADIATION WITH MATTER 12**

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 12**

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: 45L + 15T = 60 HOURS**

**Course outcome:**

CO1: Students will gain an understanding of the basic physics of nuclear science - atomic and nuclear structure, nuclear stability, radioactivity, interactions of radiation with matter, nuclear reactions and radionuclide production

CO2: Understand the principles and use of imaging devices and nuclear medicine instrumentation

CO3: To learn energy deposition for both ionizing photon interactions and transport in matter and for energetic charged particle interactions and transport in matter. Radiation sources include radioactivity, x-ray tubes, and linear accelerators.

CO4: Understand the theoretical details of ion-chamber based dosimetry

CO5: Use Bioheat transfer to analyze therapeutic uses of thermal, electromagnetic and ultrasound energies.

CO6: Explain non-thermal tissue and cellular responses to electromagnetic and acoustic energies.

**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 Chur Chill 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.

**15EBM009 MICROPROCESSOR, MICROCONTROLLER AND SYSTEM DESIGN 3003**

**UNIT I ARCHITECTURE OF 8085 /8086 9**

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

**UNIT II 8086 ASSEMBLY LANGUAGE PROGRAMMING 9**

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

**UNIT III PERIPHERAL INTERFACING & APPLICATION 9**

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

**UNIT IV MICROCONTROLLER 9**

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

**UNIT V 8086 AND 8051 BASED SYSTEM DESIGN 9**

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

**TOTAL:45 HOURS**

**Course Outcome:**

At the end of this course, students will be able to :

CO1: Understand the architecture of 8085 and 8051.
CO2: Impart the knowledge about the instruction set.
CO3: Understand the basic idea about the data transfer schemes and its applications.
CO4: Develop skill in simple program writing for 8051 & 8085 and applications.
CO5: Understand the Multichannel biomedical data acquisition for acquiring the Biosignals.
CO6: Understand and apply the peripheral interfacing of keyboard ADC and DAC

**TEXTBOOKS:**

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

**REFERENCES:**

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

**15EBM010 ELECTRONIC CIRCUITS 3103**

**COURSE OBJECTIVES:**

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

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

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

**UNIT II SMALL SIGNAL AMPLIFIERS 9**

Two port network, h-parameter model – small signal analysis of BJT (CE and CC configurations only) — high frequency model of BJT – (CE configuration only) - small signal analysis of JFET (CS configuration only) - Frequency response of BJT and FET.

**UNIT III FEEDBACK AMPLIFIER AND OSCILLATORS 9**

Basic of feedback system (block diagram approach) – Types of feedback amplifier – Basic principles of oscillator. Audio oscillators – RC phase shift and wein bridge oscillator. RF oscillators – Heartly and Collpit oscillator – Crystal oscillator,Multivibrators.

**UNIT IV POWER AMPLIFIERS 9**

Definition – Types of power amplifiers – Class A (series fed – transformer coupled )- Class B amplifier – Class-B push-pull amplifier – Complimentary symmetry type - Class-C amplifier – Heat sinking .

**UNIT V VOLTAGE REGULATIONS 9**

Shunt voltage regulator – Series voltage regulator – current limiting – feedback technique – SMPS (Block diagram approach) – DC to DC converter - Three terminal IC regulators (78XX and 79XX).

**TOTAL: 45L + 15T=60 HOURS**

**COURSE OUTCOME**

**The students will be able to**

CO1: Identify rectifier circuits and understand the applications
CO2: Apply the knowledge of amplifiers and oscillators to design various circuits
CO3: Acquire deeper knowledge of various transistors and their working
CO4: Learn about various voltage regulations to choose the apt regulators for a particular need
CO5: Identify various power amplifiers and their role in circuits
CO6: Understand SMPS & its working required for equipments

**TEXT BOOK:**

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

**REFERENCES:**

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

**15BESY41 BASIC LIFE SKILLS 1 0 1 2**

**OBJECTIVE:**

Providing value education to improve the students' character - understanding of principled life and physical health - maintaining youthfulness - measures and methods in five aspects of life

**UNIT I: PHYSICAL HEALTH 6**

1. Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.
2. Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.
3. Yogasanas: Pranamasana - Hastha Uttanasana - Pada Hasthasana – AswaSanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.
4. Pranayama : Naddi suddi - Clearance Practice - Benefits.

**UNIT II: LIFE FORCE 6**

1. Reasons for Diseases - Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
2. Philosophy of Kaya kalpa - Physical body - Sexual vital fluid - Life force -Bio-Magnetism - Mind.
3. Maintaining youthfulness : Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid –
4. Measure and method in five aspects of life - Controlling undue Passion.
5. Kayakalpa practice - Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

**UNIT III: MENTAL HEALTH 6**

1) Mental Frequencies - Beta, Apha, Theta and Delta wave - Agna Meditation explanation - benefits.
2) Shanthi Meditation explanation - Benefits
3) Thuriya Meditation explanation - Benefits
4) Benefits of Blessing - Self blessing (Auto suggestion) - Family blessing - Blessing the others - World blessing - Divine protection

**UNIT IV: VALUES 6**

- Human Values:
  1) Self control - Self confidence - Honesty
  2) Contentment - Humility - Modesty
  3) Tolerance - Adjustment - Sacrifice - Forgiveness
  4) Purity (Body, Dress, Environment) - Physical purity - Mental purity - Spiritual purity
- Social Values:
  1) Non violence - Service
  2) Patriotism - Equality
  3) Respect for parents and elders - care and protection - Respect for teacher
  4) Punctuality - Time Management

**UNIT V: MORALITY** (VIRTUES) **6**

1) Importance of Introspection - I - Mine (Ego, Possessiveness).
2) Six Evil Temperaments - Greed - Anger - Miserliness - Immoral sexual passion - Inferiority and superiority Complex – Vengeance.
3) Maneuvering of Six Temperaments - Contentment - Tolerance - Charity - Chastity - Equality - Pardon (Forgiveness).
4) Five essential Qualities acquired through Meditation: Perspicacity - Magnanimity - Receptivity - Adaptability – Creativity.
5) Improved Memory Power - Success in the Examination.

**Total: 30 HOURS.**

**REFERENCE BOOKS:**


1. Vethathiri Maharishi, 16th Edi.2013, Yoga for Modern Age, Vethathiri Publications, Erode.
2. Vethathiri Maharishi, 2014, Simplified Physical Exercises, Vethathiri Publications, Erode.
3. Vethathiri Maharishi, 3rd Edi.2014, Kayakalpam, Vethathiri Publications, Erode.
4. Rev.Dr.G.U.pope, 2016, Thirukkural, Giri Trading Agency,
5. Vethathiri Maharishi, 1994, Mind, Vethathiri Publications, Erode.
6. Chandrasekaran.K, 1999, Sound Health through yoga, Sedapati, Tamilnadu, Premkalyan Publications.
7. Iyengar, B.K.S. 2008, Light on Yoga, Noida, UP India, Harber Collins Publishing India Ltd.,


**15EBM009 MICROPROCESSOR AND MICROCONTROLLER LABORATORY 0032**

**Assembly Language Programming of 8085 8086 based experiments**

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

**Programming for 8086 8051 based experiments**

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

**TOTAL:45 PERIODS**

**Requirments:**
1.8085 Trainer Kit
2. 8051 Trainer Kit
3. 8086 Trainer Kit
4. 8255 Addon card (PPI) compatable with 8085/8051/8086.
5. 8251 Addon card (Serial) compatable with 8085/8051/8086.
6. 8279 Addon card compatible with 8085/8051/8086.
7. Stepper Motor & Interfacing card Compatible.
8. ADC x DAC Interfacing card compatible with 8085/8051/8086.
9. LED & LCD Interfacing card.
10. 8086 Macro assembler with PC P(IV).
11. Personal Computer

**Course Outcome:**

CO1: Perform programmes in 8085 and 8051.
CO2: Impart the knowledge about the instruction set.
CO3: Understand the basic idea about the data transfer schemes and its applications.
CO4: Understand the Multichannel biomedical data acquisition for acquiring the Biosignals.
CO5: Understand and apply the peripheral interfacing of keyboard ADC and DAC with different equipments

**15EBM012 ELECTRONIC CIRCUITS LABORATORY 0032**

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

**TOTAL: 45HOURS**

**Requirements**
1.Variable DC Power Supply 10 (0-30V)
2 Fixed Power Supply 5 + / - 12V
3 CRO 30MHz
4 Multimeter Digital
5 Function Generator 1 MHz
6 Digital LCR Meter

7 BC107, BF195, 2N2222, BC147, BFW10, SL100
8 IC 555, LEDs
9 Resistors 1/4 Watt Assorted
10 Capacitors
11 Inductors
12 Bread Boards
13 Transformer Diodes, Zener Diodes

**Course outcome**

CO1: Students will have a thorough understanding of operational amplifier, 741 IC
CO2: Students will be able to design digital circuits using operational amplifiers for various applications such as digital electronics and computer processing.
CO3: Students will be able to design and implement basic analog circuits in medical applications of patient monitoring and bio signal processing.
CO4: Familiarize with design and set up of amplifiers and filters that can be used in measurement of biological parameters.
CO5: Understanding of Multiplexers, De multiplexers, adders, Encoder and decoder implementation.
CO6: Able to identify application areas of integrator and differentiator in various bio signal processing.
CO7: Gain the ability to know the differences between analog and Digital Integrated IC's
CO8: Students will demonstrate their knowledge by designing analog circuits & digital circuits.

## SEMESTER V

**15EBM014 BIOMEDICAL INSTRUMENTATION 3103**

**Course Objective:** The enable students to understand electrical and non-electrical physiological measurements and bioamplifiers.

**UNIT- I BIO POTENTIAL ELECTRODES 13**
Origin of bio potential and its propagation. Electrode-electrolyte interface, electrode–skin interface, half cell potential, impedance, polarization effects of electrode – nonpolarizable electrodes. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes.

**UNIT- II ELECTRODE CONFIGURATIONS 12**
Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven's triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

**UNIT -III BIO AMPLIFIER 10**
Need for bio-amplifier - single ended bio-amplifier, differential bio-amplifier – right leg driven ECG amplifier. Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference

**UNIT- IV MEASUREMENT OF NON-ELECTRICAL PARAMETERS 15**
Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods -auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure

amplifiers - systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

**UNIT- V BIO-CHEMICAL MEASUREMENT 10**

Biochemical sensors - pH, $pO_2$ and $pCO_2$, 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 L + 15 T= 60 HOURS**

**Course Outcome**:

CO1: Background knowledge of biomedical instruments and specific applications of biomedical engineering

CO2: Understanding of how several bio signals that generating from the human body.

CO3: Familiarize students with various types of electrodes used for diagnosis and their comparison

CO4: Have a basic understanding of electrode configurations for different diagnostic methods, relevant for biomedical instrumentation.

CO5: Able to identify types and characteristics of bio amplifiers and its applications.

CO6: Understanding of principle and operation behind measurement of all non-electrical parameters.

CO7: Analyze and evaluate difference type of biochemical sensors and instruments for biochemical measurement.

**TEXT BOOKS:**

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004.

2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.

**REFERENCES:**

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.

2. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design"

3. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

**15EBM015 SENSORS AND MEASUREMENTS 3103**

**Course Objective:** To teach the studentsthe purpose of measurement, the methods of measurements, errors associated with measurements. Know the principle of transduction, classifications and the characteristics of different transducers and study its Biomedical applications and know the different display and recording devices.

**UNIT- I SCIENCE OF MEASUREMENT 10**

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 15**

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 10**

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, Photo conductive cells,photo diodes, phototransistor, comparison of photoelectric transducers, pectro photometric applications of photo electric transducers. Piezoelectric active transducer and biomedical applications as pressure & Ultrasound transducer.

**UNIT- IV SIGNAL CONDITIONING & SIGNAL ANALYSER 10**

AC and DC Bridges –wheat stone bridge, Kelvin, Maxwell, Hay, Schering – Concepts of filters, Preamplifier – impedance matching circuits – isolation amplifier. Spectrum analyzer.

**UNIT-V DISPLAY AND RECORDING DEVICES 15**

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 L + 15 T= 60 HOURS**

**COURSE OUTCOME :**

The students will be able to

CO1: Identify various measurement systems and calibration standards

CO2: Apply the knowledge of calibration standards in equipments

CO3: Understand the various classification of sensors and their characteristics

CO4: To acquire knowledge about different bridges and amplifiers

CO5: To acquire knowledge about different display and recording devices

**TEXT BOOK:**

1. A.K.Sawhney, "Electrical & Electronics Measurement and Instrumentation",10th edition, Dhanpat Rai & Co, New Delhi, 2010.

**REFERENCES:**

1. Ernest O Doebelin and Dhanesh N Manik, Measurement systems, Application and design, 5th edition, Mc Graw-Hill, 2007.

2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.

3. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.

4. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004.

5. L.A Geddas and L.E.Baker, "Principles of Applied Biomedical Instrumentation", John Wiley andSons, Third Edition, Reprint 2008.
6. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

**15EBM016 MEDICAL OPTICS 3103**

**Course Objective:** To study about the optical properties of the tissues and the applications of laser in diagnosis and therapy.

**UNIT I OPTICAL PROPERTIES OF THE TISSUES 12**

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

**UNIT II INSTRUMENTATION IN PHOTONICS 12**

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 12**

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

**UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS 12**

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 12**

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

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: Lists the basic properties of light in tissue.
CO2: Explains the mechanism, properties and interaction of laser with tissue
CO3: Description about the Instruments used in optics for measurement of the properties.
CO4: Lists the therapeutic applications of lasers and its safety procedures.
CO5: Explains surgical application of lasers in different fields.
CO6: Describes the non-thermal diagnostic applications mainly imaging techniques.
CO7: Recognition of various channel detectors for optical light.
CO8: Lists the applications of light and laser in the field of medicine and biology.

**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.

**15EBM017 BIOMEDICAL INSTRUMENTATION LABORATORY 0 0 3 2**

**LIST OF EXPERIMENTS**

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

**TOTAL:45 PERIODS**

**Requirements**

Low Persistance CRO
Low Frequency Oscillator (1 Hz to 5 KHz and above)
Digital Multimeter
Thermistor, Thermocouple, RTD module with accessories
Pulse rate measurement setup with accessories
Respiration rate measurement setup with accessories
Ultrasound Doppler flow meter
Electrosurgical unit
GSR Measurement setup with accessories
Audiometer (air conduction, bone conduction test).
PH meter
Conductivity meter. CRO (0-5 MHz)
Op-Amp [µA741 or equivalent]

**Course outcome**

CO1: Understand practical aspects of measurement and instrumentation
CO2: Understand the limitations of physiological measurements
CO3: Gain the knowledge of non-electrical parameter measurement such as temperature, blood flow, pulse rate and respiration rate.
CO4: Learn to design, build, and test biomedical instrumentation equipment.
CO5: Learn to acquire measurements and interpret data from physiological systems
CO6: With widespread use and requirements of medical instruments, this course gives knowledge of the principle of operation and design of biomedical instruments.
CO7: They will have knowledge of the principle operation and design and the background knowledge of biomedical instruments and specific applications of biomedical engineering.
CO8 : Familiarized with working, procedure and application levels of GSR and Audiometry.

**15EBM018 SENSORS AND MEASUREMENTS LABORATORY 0032**

**Course Objective:** To study and analyze the theory and practical characteristics of the various transducers for the measurement of the vital physiological signals. To get familiar with the various types of transducers and to study the compatibility for any
clinical measurements

**LIST OF EXPERIMENTS**

1. Characteristics of pressure transducer
2. Measurement of displacement capacitive transducer, LVDT and Inductive transducer
3. Characteristics of optical transducer for $SpO_2$ measurement
4. Measurement of skin temperature by both contact and non-contact method
5. Study of the characteristics of capacitor level sensor for saline level measurement in a I-V set.
6. Data acquisition of physiological signals
7. Study of hot-wire anemometry
8. Study of amperometric sensor for blood glucose measurement
9. Electronic weighing machine for the measurement of chemical compounds
10. Non-invasive gas analyzer as an electronic nose.

**TOTAL:45 HOURS**

**Course outcome:**

CO1: To gain knowledge about various theory and practical characteristics of the various transducers
CO2: To gain knowledge about the measurement of the vital physiological signals.
CO3: To get familiar with the various types of transducers
CO4: To study the compatibility for anyclinical measurements
CO5: To measure blood glucose level
CO6: To measure non invasive gas electronically

## SEMESTER VI

**15EBT019 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT 3103**

**Course Objective:** To enable the students to understand the medical devices applied in measurement of parameters related to cardiology, neurology and the methods of continuous monitoring and transmitting them, learn some of the cardiac assist devices, measure the signals generated by muscles and understand the need and use of some of the 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, Epilepsy, 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, Instrumentation for measuring the mechanics of breathing – functioning of bubble, disc type and membrane type oxygenerators, finger pump, roller pump, electronic monitoring of functional parameter. 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. Hemo Dialyser unit, Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy. Thermography – Recording and clinical application, ophthalmic instruments. 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.

**TOTAL: 45 HOURS**

**Course Outcome:**

The students will :

CO1: gain knowledge about the varoius cardiac diseases and able to distnguish normal and abnormal ecg waves

CO2: Learn about the basic working of cardiac monitoring devices.

CO3: Understand the various methods to diagnose neurological signals.

CO4: Understand practical applications of telemetry in biomedical engineering

CO5: Understand the clinical importance of various life saving equipments and know about their basic working

CO6: Acquire skills to relate the theoretical principles of equipments and diagnostic needs.

**TEXT BOOK:**

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 2003.

**REFERENCES:**

1. Myer Kutz, "Standard Handbook of Biomedical Engineering & Design", Mc Graw Hill, 2003.
2. L.A Geddes and L.E.Baker, "Principles of Applied Biomedical Instrumentation", 3rd Edition, 2008
3. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Pearson Education, New Delhi, 2007.
4. Antony Y.K.Chan, "Biomedical Device Technology, Principles and design", Charles Thomas Publisher Ltd, Illinois, USA, 2008.
5. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson education, 2004.
6. John G.Webster, "Medical Instrumentation Application and Design", third edition, John Wiley and Sons, New York, 2006.

**15EBM020 DIGITAL SIGNAL IMAGE PROCESSING 3103**

**Course Objective:** To learn the fundamental concepts of medical image acquisition and understand how to apply the image processing techniques for various medical images. To learn the image fundamentals and mathematical transforms necessary for image processing, study the various image enhancement techniques, apply various image restoration procedures in Medical images. To gain knowledge about the basic concepts of image compression procedures and study about the various segmentation techniques applied to Medical Images.

**UNIT I FUNDAMENTALS OF DIGITAL IMAGE AND TRANSFORMS 12**

Elements of Visual perception, Image sampling and quantization, Neighborhood pixel Relationships – Basic Image operations – Arithmetic, Geometric and Morphological, Image transform: 2D DFT- Discrete cosine-, Sine-, Haar-, and Hadamard- transform.

**UNITII IMAGE ENHANCEMENT 12**

Basic gray level transformation, Histogram processing ,Smoothening by spatial filters - Sharpening by spatial filters ,Smoothening- frequency domain filters, Sharpening- frequency domain filters ,Color image Processing- color models- Pseudo color image processing– Color Image Transformation – Smoothening - Sharpening.

**UNITIII IMAGE SEGMENTATION AND OBJECT RECOGNITION 12**

Edge detection- Marr Hidreth edge detector - Canny edge detector, Thresholding foundation- Basic global thresholding - Basic Adaptive thresholding, Region Based segmentation, Watershed segmentation algorithm, Patterns and pattern classes, Recognition based on decision theoretic methods-matching, Optimum statistical classifiers.

**UNITIV IMAGE COMPRESSION 12**

Image compression- Fundamentals - Image compression standards- Coding: Run length-, Huffman- Arithmetic-, Bit plane-, Transform- and Lossy- and lossless predictive coding.

**UNIT V IMAGE RESTORATION AND RECONSTRUCTION OF MEDICAL IMAGES 12**

Image degradation models, Algebraic approach to restoration, inverse filtering, Least mean square filter, Image reconstruction from projections – Radon transforms - Filter back projection algorithm – Fourier reconstruction of MRI Images

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

The students will be able to:
CO1: Recognise the vital parameters behind image medical image acquisition
CO2: Understand various techniques of image enhancement
CO3: Apply enhancement techniques on medical images for useful applications
CO4: Acquire knowledge on various segmentation techniques for disease detection
CO5: Use classification techniques to distinguish benign & malignant tumors
CO6: Understand the principles of image reconstruction & and various types of image compression

**TEXTBOOKS:**

1. Rafael C, Gonzalez and Richard E Woods, "Digital Image Processing",Pearson Education Asia, Third Edition, 2007.
2. Anil K Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2nd edition 1997.

**REFERENCES:**

1. William K Pratt, "Digital Image Processing", John Wiley NJ, 4th Edition, 2007.
2. Albert Macouski, "Medical Imaging Systems", Prentice Hall, New Jersey 2nd edition 1997.

**15EBM021 RADIOLOGICAL EQUIPMENT 3 1 0 3**

**Course Objective:** To teach the students and make them understand generation of x-rays and its uses in imaging, different types of radio diagnostic techniques. To enable them to learn techniques used for visualizing different sections of the body, learn radiation therapy methodologies and the radiation safety.

**UNIT- I MEDICAL X-RAY EQUIPMENT 12**

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 12**

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 12**

Fundamentals of magnetic resonance- Interaction of Nuclei with static magnetic field and Radiofrequency 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 12**

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 12**

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3DCRT – IMRT – IGRT and Cyber knife- radiation measuring instruments- Dosimeter, film badges, Thermo Luminescent dosimeters- electronic dosimeter- Radiation protection in medicine- radiation protection principles.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

The students will be able to:

CO1: Acquire knowledge on the basic fundamentals of x-rays, and how it is exploited in medical use

CO2: Understand diagnosis of heart abnormalities via x-ray intensifiers

CO3: Learn about the evolution of computed tomography and understand its applications

CO4: Distinguish between various diagnostic equipments and compare their advantages and disadvantages

CO5: Recognise safety measures while using radiological equipments

CO6: Apply practical knowledge of safety measures while handling the equipments

CO7: Learn various methods to measure radiation levels

**TEXT BOOKS:**

1. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988 (Units I, II, III & IV).

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.

**15EBT022 DIGITAL SIGNAL IMAGE PROCESSING LABORATORY 0032**

**Course Objective:** To practice the basic image processing techniques, understand the functions of transforms, know the effect of quantization and to explore the applications of image processing.

**LIST OF EXPERIMENTS**

**Simulation using MATLAB (Image processing Tool Box) or equivalent software**

1. Image sampling and quantization
2. Analysis of spatial and intensity resolution of images.
3. Intensity transformation of images.
4. DFT analysis of images
5. Transforms (Walsh, Hadamard, DCT, Haar)
6. Histogram Processing
7. Image Enhancement-Spatial filtering
8. Image Enhancement- Filtering in frequency domain
9. Image segmentation – Edge detection, line detection and point detection
10. Basic Morphological operations.
11. Basic Thresholding functions
12. Analysis of images with different color models.

**TOTAL: 45 HOURS**

**Course outcome:**

The student gain knowledge to

CO1: To perform image sampling and quantization

CO2: To perform spatial analysis of the image

CO3: To perform different transforms on the images

CO4: To perform histogram on the images

CO5: To perform different filtering in spatial & frequency domain

CO6: To perform morphological and thresholding functions

CO7:To analyse different color models on the images

**15EBM023 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LABORATORY 0032**

**LIST OF EXPERIMENTS**

Recording and analysis of ECG signals
Recording and analysis of EEG signals.
Recording - Fatigue test of EMG signals.
Simulation of ECG – detection of QRS complex and heart rate
Study of Pacemaker simulator

Study of Defibrillator simulator
Study of shortwave and ultrasonic diathermy.
Study of biotelemetry Electrical safety measurements.

**TOTAL: 45HOURS**

**Course outcome:**

CO1: To perform ECG analysis
CO2: To record and analyse EEG signals
CO3: To record and analyse EMG signals
CO4: To perform pacemaker and defibrillator simultors
CO5: To perform heat therapy using diathermy
CO6: To execute biotelemetry experiments

**15EBT024 MINI PROJECT 0032**

Students should visit any Health care industry or Hospital and learn the techniques there and submit a report with certified from the respective industry

**15EBM025 PATTERN RECOGNITION AND NEURAL NETWORKS 3103**

**Course Objective:** The course will introduce the student to the fundamentals of pattern recognition and its application, 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 will also cover basic neural network architectures and learning algorithms, for applications in pattern recognition, image processing, and computer vision.

**UNIT - I INTRODUCTION AND SUPERVISED LEARNING 12**

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 12**

Unsupervised learning- Hierarchial 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 12**

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 12**

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

**UNIT - V NEURAL NETWORKS BASED ON COMPETITION 12**

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

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

After completing this course, the students will get adequate understanding and implementations about the Artificial Neural Networks and Machine Leaning with applications to Pattern Recognition and Data Mining.

CO1:It helps to gain theoretical knowledge in Pattern recognition techniques which are used to design automated systems that improve their own performance through experience.

CO2:This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives.

CO3:It clearly defines the basic concepts in pattern recognition.

CO4:It gives a clear understanding about the application of supervised learning and the implementation of neural networks in engineering,artificial intelligence and cognitive modelling.

CO5: They will gain knowledge about state-of-the-art algorithms used in pattern recognition research.

CO6:They can clearly understand pattern recognition theories, such as Bayes classifier and linear discriminant analysis.

The students will have a clear understanding of the concepts and techniques of neural networks through the study of the most important neural network models.

CO7: The goal of this course is to implement and apply the pattern recognition techniques in practical problems.

**TEXT BOOKS:**

1. Duda R.O. Hart P.G, “Pattern Classification and scene analysis”, Wiley Edition 2000 .
2. Hagan, Demuth and Beale, “Neural network design”, Vikas Publishing House Pvt Ltd., New Delhi, 2002.

**REFERENCES:**

1. Freeman J.A., and Skapura B.M, “Neural Networks, Algorithms, Applications and Programming Techniques”, Addison - Wesley, 2003.

2. Earl Gose, Richard Johnsonbaugh Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt Ltd., New Delhi, 1999.
3. Robert Schalkoff, “Pattern recognition, Statistical, Structural and neural approaches” John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2005.
4. Laurene Fausett, “Fundamentals of neural networks- Architectures, algorithms and applications”,Prentice Hall, 1994.

**15EBM026 MEDICAL INFORMATICS 3003**

**Course Objective:** The student will learn ICT applications in medicine with an introduction to health informatics, understand 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 12**

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

**UNIT- II MEDICAL STANDARDS 12**

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

**UNIT - III MEDICAL DATA STORAGE AND AUTOMATION 12**

Representation of Data, Data modeling Techniques, Relational Hierarchical and network Approach, Normalization techniques for Data handling - 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 12**

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 12**

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= 60 HOURS**

**Course Outcomes**:

CO1: The student will clearly gain information about the intersection of information science, computer science, and health care. This field deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.
CO2:It gives information about collecting, storing and using information which has always been an integral part of the practice of medicine.
CO3:It gives a brief understanding about handling medical records ranging from simple record-keeping to accessing and using computer-based data.
CO4:It briefly defines the role of informatics in the day-to-day care of patients and the advancement of medical science .
CO5:It helps the students to interpret health policy and systems, with the ability to integrate policies into the healthcare agency.
CO6:The theory of health Informatics helps the students to analyze, design and develop information systems that enhance operational efficiencies and strategic goals of the organization.
CO7:The goal of this course is to analyze data utilize analytic technologies to improve the organization efficiencies and operational effectiveness.

**TEXT BOOKS:**

1. R. D. Lele, "Computers in medicine progress in medical informatics", Tata McGraw Hill Publishing Ltd, 2005.
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003.

**REFERENCES:**

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

**15EBM027 VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL SYSTEMS 3103**

**Course Objective:** To impart adequate knowledge on Virtual Instrumentation for acquisition and analysis of signals in medical system, to educate about the Basic concepts of VI, programming concepts of VI and enable them to implement VI in medical systems

**UNIT- I INTRODUCTION TO VIRTUAL INSTRUMENTATION (VI) 12**

Virtual instrumentation (VI): Evolution, Definition, Architecture- Conventional-, and Distributed- VI, Comparison of VI with traditional Instruments, Need of VI, advantages, block diagram, data flow techniques, graphical programming, Comparison between graphical programming and conventional programming, VI in engineering process.

**UNIT- II PROGRAMMING MODES IN VI 12**

VI: front panel, Block diagram, LABVIEW Environment: Startup-, Shortcut-, and Pull down menu, Palletes, Control structures: FOR loop, WHILE loop, Shift Registers, feedback nodes, Selection Structures: Case and sequence structures, Formulae nodes, Arrays, Clusters, Waveform Chart and graph, XY Graph, Strings, Tables, File I/O functions.

**UNIT- III HARDWARE ASPECTS OF VI SYSTEM 12**

Digital I/O Techniques: pull-up and pull down resistors, TTL to solid state Relays, Voltage dividers, data acquisition in LABVIEW, hardware installation and configuration, Data acquisition (DAQ): Components, Accessories, Hardware, and Software**.**

**UNIT- IV COMMON INSTRUMENT INTERFACE 12**

Current loop:4-20mA,60mA, RS232, RS422, RS485, General purpose interface bus(GIPB) ,Virtual Instrument Software Architecture (VISA), Universal serial port bus(USB), Peripheral computer interface (PCI), VME extensions for instrumentation (VXI), PCI extensions for Instrumentation (PXI), Personal Computer Memory Card International Association (PCMCIA), Signal conditioning extension for instrumentation (SCXI).

**UNIT –V ANALYSIS TOOLS AND APPLICATIONS OF VI 12**

Fourier transform, Power spectrum, Correlation, Windowing, filtering, Oscilloscope, Waveform generator, Multi-channel data acquisition using LABVIEW, ECG acquisition for long term monitoring of heart rate using VI

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course outcomes:**

CO1:The student will gain basic knowledge in such a manner that they are able to acquire required learning out comes in virtual instrument concepts.
CO2: It gives a brief understanding about proper data acquisition hardware.
CO3: The concept helps to configure data acquisition hardware in LabVIEW. The related hardware like DAQ and transducers.
CO4: Create virtual instruments for practical works.
CO5: The students can get a detailed knowledge about DAQ software,hardware and installation.
CO6: It gives a deep understanding about the importance and applications of virtual instrumentation.
CO7: They will develop a good knowledge on basic programming concepts in LabVIEW.
CO8: The goal of this course is to provide an introduction to the principles of different Data Acquisition System concepts and develop real time applications using LabVIEW.

**TEXTBOOKS:**

1. Gary Jonson, "Labview Graphical Programming", Second Edition, McGraw Hill, New York, Fourth edition 2006.
2. Lisa K wells & Jeffrey Travis, "Labview for everyone", Prentice Hall Inc, New Jersey, First edition 1997.

**REFERENCES:**

1. Gupta S J, Gu.pta P, "PC interfacing for Data Acquisition & Process Control", Instrument Society of America, Second Edition, 1994.
*2* Technical Manuals for DAS Modules of Advantech and National Instruments

**15EBM028 BIOMECHANICS 3103**

**Course Objective:** The student will beexposed to principles of mechanics, learn the mechanics of physiological systems, be familiar with the mathematical models used in the analysis of biomechanical systems.

**UNIT- I INTRODUCTION TO MECHANICS 12**

Principles of Mechanics, Vector mechanics, Mechanics of motion - Newton's laws of motion, Kinetics, Kinematics of motion, Fluid mechanics – Euler equations and Navier Stoke's equations, Viscoelasticity, Constitutive equations, Stress transformations, Strain energy function.

**UNIT -II BIOFLUID MECHANICS 12**

Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow. Cardiovascular system - biological and mechanical valves development, artificial heart valves testing of valves, Structure, functions, material properties and modeling of Blood vessels.

**UNIT- III BIOSOLID MECHANICS 12**

**Hard Tissues:** Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy.
**Soft Tissues:** Structure, functions, material properties and modeling of Soft Tissues: Cartilage, Tendon, Ligament, Muscle.

**UNIT- IV BIOMECHANICS OF JOINTS AND IMPLANTS 12**

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle. Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.

**UNIT- V MODELLING AND ERGONOMICS 12**

Introduction to Finite Element Analysis, Analysis of bio mechanical systems using Finite element methods, Graphical design. Ergonomics- Gait analysis, Design of work station, Sports biomechanics. Injury mechanics.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: The students will gain basic knowledge on the structure and function of biological systems such as humans, animals, plants, organs, fungi, and cells by means of the methods of mechanics.

CO2: The subject aims to help students to build up a detailed knowledge of the Laws of Newtonian and fluid mechanics,Mechanics of non-moving (static) and moving (dynamic) systems of hip,knee and spinal cord systems,Kinematics or spatiotemporal aspects of motion,

CO3: It helps the students to evaluate Kinetics or forces that act on a body and influence its movement or stability of hard tissues and soft tissues of a human body.

CO4: It helps to analyse and describe the motion of a body or system using qualitative and quantitative approaches (instrumentation),Mathematical foundations of movement

CO5: It gives a brief understanding for the students about basic concepts of human skeletal muscle mechanics.

CO6: The students can understand clearly regarding the human factors, ergonomics,basic concepts of energy expenditure and gait analysis regarding sport and injury biomechanics.

CO7: The goal of this course is to evaluate the mechanics behind human motion and performance.

**TEXT BOOKS:**

1. Y.C. Fung, "Bio-Mechanics- Mechanical Properties of Tissues", Springer-Verlag, 1998.
2. Duane Knudson, "Fundamentals of Biomechanics", Second Edition Springer Science+Business Media, 2007
3. Marcelo Epstein, "The Elements of Continuum Biomechanics", ISBN: 978-1-119-99923-2, 2012.

**REFERENCES:**

1. Jay D. Humphrey, Sherry De Lange, "An Introduction to Biomechanics: Solids and Fluids, Analysis and Design" , Springer Science+Business Media, 2004.
2. Shrawan Kumar, "Biomechanics in Ergonomics", Second Edition, CRC Press 2007.

**15EBT029 VIRTUAL INSTRUMENTATION DESIGN FOR MEDICAL SYSTEM LABORATORY 0032**

**Course Objective:** To impart adequate knowledge on programming in Virtual Instrumentation for acquisition and analysis of signals in medical system and to impart knowledge on various analysis tools

**LIST OF EXPERIMENTS**

1. Basic arithmetic operations
2. Boolean operations
3. Sum of 'n' numbers using 'for' loop
4. Factorial of a give number using for loop
5. Sum of 'n' natural numbers using while loop
6. Factorial of a give number using while loop
7. Sorting even numbers using while loop in an array
8. Array maximum and minimum
9. Bundle and unbundle cluster
10. Flat and stacked sequence
11. Application using formula node
12. Median filter
13. Discrete cosine transform
14. Convolution of two signals
15. Windowing technique
16. Instrumentation of an amplifier to acquire an ECG signal using NI vision acquisition software
17. To measure BP, heart rate, temperature, ECG using vernier biomedical sensor kit
18. Acquire, analyse and present an EEG instrumentation using NI ELVIS hardware

**TOTAL: 45 HOURS**

**Course outcome:**

- To perform Basic arithmetic operations, Boolean operations, Sum of ‘n’ numbers using ‘for’ loop, Sum of ‘n’ natural numbers using while loop
- To perform Factorial of a give number using for loop
- To perform Sorting even numbers using while loop in an array, Array maximum and minimum
- To perform Bundle and unbundle cluster, Flat and stacked sequence, Application using formula node
- To perform filtering and windowing technique
- To perform acquisition of ECG signal using NI vision acquisition software, NI ELVIS hardware

**15EBM030 MEDICAL IMAGE PROCESSING AND ANALYSIS LABORATORY 0032**

**Course Objective:** To gain the practical knowledge about the processing of medical images, understand the fundamentals of digital image and its properties. To enhance the medical images by applying various filters and segment the region of interest using various image processing Algorithms.

**LIST OF EXPERIMENTS**

1. Digital image Fundamentals.
2. Image Enhancement
3. Removal of noise in medical images.
4. Image Transformation in spatial domain and frequency domain.
5. Edge detection and boundary tracing techniques.
6. Region based processing
7. Color image processing
8. Statistical Image Analysis.
9. Image compressions.
10. Image segmentation by thresholding.

**TOTAL = 45 HOURS**

**Course outcome:**

The student gain knowledge to

CO1:To perform image enhancement

CO2: To perform removal of noise

CO3: To perform different transforms on the images

CO4: To perform boundary detection

CO5: To perform different filtering in spatial & frequency domain

CO6: To perform edge & region based processing

CO7:To perform compression and segmentation of image

## SEMESTER 8

**15EBT031 PROSTHETIC ENGINEERING 3003**

**Course Objective:** To enable students to helpextend knowledge of the amputee, of lost and remaining functions affecting locomotion, and to collect information on the best possible medical treatment. To improve fitting techniques and practices, including training.

**UNIT – I** **12**

**ENGINEERING CONCEPTS IN SENSORY REHABILITATION**

Motor Rehabilitation, Communication Disorders, Computer-Aided Engineering in customized component design. Intelligent prosthetic knee, Hierarchically controlled prosthetic hand, Self-aligning orthotic knee joint. Externally powered and controlled orthotics and prosthetics: FES systems: Restoration of hand function, standing and walking. Hybrid Assistive Systems (HAS). Active Above Knee Prostheses. Myoelectric hand and arm prostheses.

**UNIT – II WHEELED MOBILITY 12**

Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of Wheel chair propulsion. Power Wheelchair Electrical Systems. Control. Personal Transportation. Auxiliary devices and systems.

**UNIT – III** **12**

**SENSORY AUGMENTATION AND SUBSTITUTION**

Visual system: Visual augmentation. Tactual vision substitution, Auditory vision substitution; Auditory system: Auditory augmentation. Cochlear implantation, Visual auditory substitution, Tactual auditory substitution, Tactual system: Tactual augmentation. Tactual substitution, Augmentative communication, Control and Computer Access: User Interface, Cost-Effectiveness of High – Verses Low – technology Approaches, Intervention and other Issues.

**UNIT – IV MEASUREMENT TOOLS AND PROCESSES 12**

Subjective and Objective measurement methods, Measurements and assessments; measurement Objectives and Approaches; Characterising the human system and subsystems. Characterising tasks. Characterising assitive devices. Characterizing overall systems in high-level-task situations. Decision-Making process: Current Limitations: Quality of measurements, Standards. Rehabilitation service delivery.

**UNIT – V COMPUTER APPLICATIONS IN REHABILITATION ENGINEERING** **12**

Interfaces in Compensation for visual perception. Improvement of orientation and mobility. Computer-assisted lip reading. Brain-computer interfaces.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course outcome:**

**The students will be able to:**

**CO1: Apply the engineering concepts to design the basic orthotics and prosthesis of limb**

**CO2: Understand externally powered prosthesis and orthptics**

**CO3: Acquire understanding regarding the various wheel chair types and it's working**

**CO4: Learn about augmentation devices and understand their functions**

**CO5: Learn brain control interfaces and their emerging benefits**

**CO6: Understand the various aspects of designing considering the standards and existing limitations**

**TEXTBOOKS:**

1. Robinson C.J., Rehabilitation Engineering, CRC Press, 1995.

2. Ballabio E., *et al.*,Rehabilitation Technology, IOS Press, 1993.

## SYLLABUS
## LIST OF DISCIPLINE SPECIFIC ELECTIVE COURSES

**15EBM101 ANALOG AND DIGITAL IC's 3103**

**Course Objective**: To teach the students the basic of the Digital systems, application of analog ICs in the designing circuit, study the applications of these Digital ICs,

**UNIT - I NUMBER SYSTEMS AND LOGIC GATES** **12**

Decimal, Binary, Octal and Hexadecimal Numbers.-Conversion between these number systems.- Complements r's and (r-1)'s complements.- subtraction using complements – Encoding numbers and characters using Binary digits. –Binary coded Decimal –Gray code - Binary to Gray code conversion –ASCII Code. Logic gates – Truth tables – NOT, AND, OR, NOR, NAND, XOR, XNOR - Boolean Laws and theorems – Solving Boolean expressions, Truth Tables and Logic circuits – The Karnaugh Map – half adder, full adder, Multiplexers and Demultiplexers - Decoders and encoders. Coding of Combination Circuits in verilog.

**UNIT- II REGISTERS AND COUNTERS** **12**

Flip Flops – RS, D, T, JK Flip Flops – Characteristic equations, exciting tables – JK Master–Slave flip-flop – Universal shift register. Design of modulo-N counters – counter design using state diagram. sequential circuit design with verilog.

**UNIT- III OPERATIONAL AMPLIFIERS 12**

The characteristics of Ideal Operation – slew rate, offset voltage, bias current, CMRR, bandwidth - equivalent circuit of an op-Amp – virtual ground concept – Linear applications of op-amp – inverting and noninverting amplifier, summing, subtracting, averaging amplifier - voltage to current converter – current to voltage converter – Differential amplifiers – differentiator and integrator. Nonlinear applications – comparator – Schmitt Triggers – Precision Diode Half wave and full wave rectifiers – Average detectors – peak Detector.

**UNIT - IV ACTIVE FILTERS AND SIGNAL GENERATOR 12**

Active filters (first and second order) – Low pass, high pass, band pass filters, band reject filters (notch filters). Oscillators - RC Phase shift and Wein-bridge. Waveform generators - Square, triangular and saw tooth.

**UNIT- V TIMER, PLL, A/D AND D/A CONVERTERS 12**

555 Timer (internal diagram) and its applications – monostable multivibrator, astable multivibrator. Phase locked Loop (565 - block diagram approach) and its applications - Frequency multiplication, Frequency translation, voltage to frequency and frequency to voltage converters. DAC – Binary weighted DAC and R-2R DAC. ADC – single slope and dual slope ADCs, successive approximation ADC

**TOTAL: 45 L + 15T= 60 HOURS**

**Course Outcome**:

CO1: Acquire knowledge about solving problems related to number systems and Boolean algebra.

CO2: Ability to apply knowledge of logic gates in various application.

CO3: Ability to design various synchronous and asynchronous sequential circuits.

CO4: Capability to design analog circuits & digital circuits.

CO5: Understand the terminal characteristics of op-amps and analyze fundamental circuits based on op-amps.

CO6: Able to design circuits using operational amplifiers for various applications.

CO7: Understand type and applications of active filters and signal generators.

CO8: Familiarized with applications using 555 timer

**TEXT BOOKS:**

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

**REFERENCES:**

1. Robert B.Northrop, “Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation”, CRC Press, 2004.
2. Sergio Franco, “Design with Operational Amplifiers and analog Integrated circuits”, McGraw- Hills, 2003.
3. Millman J and Halkias .C., “Integrated Electronics”, TMH, 2007.
4. John. F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2007 .
5. Charles H. Roth, Jr, “Fundamentals of Logic Design”, Fourth Edition, Jaico Books, 2002.

**15EBM102 INTEGRATED CIRCUIT LABORATORY 0032**

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

**TOTAL: 45 HOURS**

**REQUIREMENTS**

Dual ,(0-30V) variable Power Supply
10 - 2 CRO 9 30MHz 3
Digital Multimeter 10 Digital
4 Function Generator 8 1 MHz
5 IC Tester (Analog/Digital) 2
6 Bread board 10 Consumables (Minimum of 25 Nos. each) 1
IC 741
IC NE555
Potentiometer Seven Segment Display
Capacitor
Resistors 1/4 Watt Assorted
Single Strand Wire 25 9 Encoder and Decoder ICs (IC7445, IC 74147)
Multiplexer and Demultiplexer ICs. ( IC74150, IC74154)
Shift register ICs, Counter ICs 25 IC7400 IC7404 IC7402 IC7408 IC7411 IC7432

**15EBM103 BIOFLUIDS AND DYNAMICS 3103**

**Course Objective:** To help the students to understand the physiology and anatomy of studied systems and develop a capability to analyse cardiac, respiratory, soft tissue and orthopedic mechanics.

**UNIT- I BIO-FLUID MECHANICS 12**

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

**UNIT – II FLOW PROPERTIES OF BLOOD** **12**

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

**UNIT - III CARDIAC MECHANICS** **12**

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

**UNIT- IV SOFT TISSUE MECHANICS** **12**

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

**UNIT - V ORTHOPEDIC MECHANICS** **12**

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

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: The students will gain basic knowledge on the structure and function of biological systems such as humans, animals, plants, organs, fungi, and cells by means of the methods of mechanics.

CO2: The subject aims to help students to build up a detailed knowledge of the Laws of Newtonian and fluid mechanics,Mechanics of non-moving (static) and moving (dynamic) systems of hip,knee and spinal cord systems,Kinematics or spatiotemporal aspects of motion,

CO3: It helps the students to evaluate Kinetics or forces that act on a body and influence its movement or stability of hard tissues and soft tissues of a human body.

CO4: It helps to analyse and describe the motion of a body or system using qualitative and quantitative approaches (instrumentation),Mathematical foundations of movement

CO5: It gives a brief understanding for the students about basic concepts of human skeletal muscle mechanics.

CO6: The students can understand clearly regarding the human factors, ergonomics,basic concepts of energy expenditure and gait analysis regarding sport and injury biomechanics.

CO7: The goal of this course is to evaluate the mechanics behind human motion and performance.

**TEXT BOOK:**

1. Y.C Fung, "Biomechanics- Mechanical properties of living tissues", 2nd Edition, Springer-Verlag, 1993.

**REFERENCES:**

1. David A. Rubenstein, Weiyin, Mary D. Frame, "Biofluid Mechanics- An Introduction to fluid Mechanics, Macrocirculation and Microcirculation", Springer, 2013.
2. Silver Frederick H. Biomaterials, Medical Devices & Tissue Engineering: Chapman & Hall, London, 1994
3. Nihanth ozkai, D.A Mc Donald ,"Biomechanics, Blood flow in arteries", Edward Arnold ltd, 1998.
4. D.O. Cooney, Biomedical Engineering Principles. Marcel Dekker, INC New York.1976.

**15 EBM 104 PHYSIOLOGICAL MODELING 3 1 0 3**

**Course Objective:** The help students understand and appreciate the value and application of Physiological models and Vital organs, Model dynamically varying physiological systems, understand methods and techniques for analysis and synthesis of dynamic models and develop differential equations to describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.

**UNIT- I**

**SYSTEM CONCEPT 12**

Review of physiological system modeling- system properties- different configurations of tracheal network, static and dynamic resistance, Thermal resistance in human systems, System with volume storage capacity and its electrical analog , Simplified model of respiratory system , Simulation of aortic segments ,Comparison of muscle model isotonic response, Step response of resistant / compliant systems –Dye dilution study of circulation, pulse response of first order system.

**UNIT- II**

**TRANSFER FUNCTION 12**

System as an operator and use of Transfer function, Bio Engineering of coupled systems, Examples of transformed signals and circuits for transfer function with impedance concept-Development of lung model, Impedance of a two stage ladder network, Measurement of airway resistance.

**UNIT- III**

**PERIODIC SIGNALS 12**

Sinusoidal Functions, Analysis of Instrumentation to measure air flow system, second order system – representation of a respiratory system, Evaluation of Transfer function from frequency response for muscle response modes, Relationship between Phase lag and Time Delay-closed loop aspects of pupillary control system , Transient Response of an Undamped Second order system, General Description of Natural Frequency Damping, Physical Significance of under damped responses of post systolic operations in aortic arch.

**UNIT -IV**

**FEEDBACK** **12**

Characterization of Physiological Feedback systems- Hypophysis adrenal systems, pupillary hippus, Uses and Testing of System Stability, Simulation-Hodgkin-Huxley model, Model of cardiovascular variability.

**UNIT- V**

**SIMULATION OF BIOLOGICAL SYSTEMS** **12**

Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system, Endocrine system, functioning of receptors, introduction to digital control system.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: The student will be able to understand the basics of physiological system modeling and system properties of different configurations of tracheal network.
CO2: The student will be able to understand the system with volume storage capacity and its electrical analog , Simplified model of respiratory system to simulate and compare the model study.
CO3: Simulation of aortic segments are studies and students will be able to measure the physiological parameters through simulations.
CO4: The students will be able to understand the System as an operator and use of Transfer function of bio Engineering coupled systems to transform signals and circuits for transfer function with impedance concept.
CO5: The students will be able to develop the lung model to measure the Impedance of a two stage ladder network and Measure the airway resistance.
CO6: The students will be able to understand the Sinusoidal Functions to analyze the Instrumentation to measure air flow system and second order representation of a respiratory system,
CO7: The students will be able to evaluate the transfer function from frequency response for muscle response models.
CO8: The student will be able to understand the Relationship between Phase lag and Time Delay-closed loop aspects of pupillary control system and Transient Response of an Undamped Second order system
CO9:The students will be able to Characterize the Physiological Feedback systems of Hypophysis adrenal systems and pupillary hippus.
CO10: The various Simulation of Hodgkin-Huxley model and Model of cardiovascular variability were studied by the student.
CO11: The student will gain knowledge on Simulation of thermal regulation, pressure and flow control in circulation, occulo motor system and Endocrine system.

**TEXT BOOKS:**

1. Willian B. Blesser, “A System Approach to Biomedicine”, Mc Graw Hill Book Co., New York, 1969 (Units I, II, III, IV).
2. Manfreo Clynes and John H.Milsum, “Biomedical Engineering System”, McGraw Hill and Co., New York , 1970 (Unit V).

3. Micheal C.K.Khoo, ”Physiological Control System” Analysis, Simulation and Estimation“.- Prentice Hall of India , New Delhi , 2001(Unit V).

**REFERENCES:**

1. Richard Skalak and Shu Chien, “Hand Book of Biomedical Engineering”, Mc Graw Hill and Co. New York, 1987.
2. Douglas S.Rigg., “Control Theory and Physiological Feedback Mechanism”, The Wilkliam and Wilkins Co. Baltimore, 1970.

**15 EBM 105 TELEMEDICINE 3 1 0 3**

**Course Objective:** The student should learn the key principles for telemedicine and health, gain an understanding of telemedical technology and know telemedical standards, mobile telemedicine and its applications.

**UNIT- I TELEMEDICINE AND HEALTH 12**

History and Evolution of telemedicine, Functional diagram of telemedicine system, Telemedicine, Telehealth, Tele care, Organs of telemedicine, Global and Indian scenario, Ethical and legal aspects of Telemedicine - Confidentiality, Social and legal issues, Safety and regulatory issues, Advances in Telemedicine.

**UNIT - II TELEMEDICAL TECHNOLOGY 12**

Principles of Multimedia - Text, Audio, Video, data, Data communications and networks, PSTN,POTS, ANT, ISDN, Internet, Air/ wireless communications: GSM satellite, and Micro wave, Modulation techniques, Types of Antenna, Integration and operational issues, Communication infrastructure for telemedicine – LAN and WAN technology. Satellite communication. Mobile hand held devices and mobile communication. Internet technology and telemedicine using world wide web (www). Video and audio conferencing. Clinical data – local and centralized.

**UNIT- III TELEMEDICAL STANDARDS 12**

Data Security and Standards: Encryption, Cryptography, Mechanisms of encryption, phases of Encryption. Protocols: TCP/IP, ISO-OSI, Standards to followed DICOM, HL7, H. 320 series (Video phone based ISBN) T. 120, H.324 (Video phone based PSTN), Video Conferencing, Real-time Telemedicine integrating doctors / Hospitals, Clinical laboratory data, Radiological data, and other clinically significant biomedical data, Administration of centralized medical data, security and confidentially of medical records and access control, Cyber laws related to telemedicine.

**UNIT - IV MOBILE TELEMEDICINE 12**

Tele radiology: Definition, Basic parts of teleradiology system: Image Acquisition system Display system, Tele pathology, multimedia databases, color images of sufficient resolution, Dynamic range, spatial resolution, compression methods, Interactive control of color, Medical information storage and management for telemedicine- patient information medical history, test reports, medical images diagnosis and treatment. Hospital information system - Doctors, paramedics, facilities available. Pharmaceutical information system.

**UNIT- V**

**TELEMEDICAL APPLICATIONS 12**

Telemedicine access to health care services – health education and self care. Introduction to robotics surgery, telesurgery. Telecardiology, Teleoncology, Telemedicine in neurosciences, Electronic Documentation, e-health services security and interoperability., Telemedicine access to health care services – health education and self care, Business aspects - Project planning and costing, Usage of telemedicine.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1:The students will gain knowledge in the remote diagnosis and treatment of patients by means of telecommunications technology.
CO2:It helps the students to demonstrate the basic knowledge of Telemedicine and Telehealth.
CO3: It clearly describes the telecommunication technology in the field of oncology,radiology,surgery and cardiology.
CO4:It helps the students to know the operation of telemedicine technology.
CO5: It clearly defines the communication technologies which acts as a baseline for telemedicine field.
CO6: Demonstrate the utilization of knowledge required to present and manage the patient with a specific problem.
CO7:It helps to demonstrate the application of communication skills in patient and medical team and to provide clinical health care from a distance.
CO8:The goal of this course is to impart the students the implementations of the communication technology in medical field.

**TEXT BOOK:**

1. Norris, A.C. "Essentials of Telemedicine and Telecare", Wiley, 2002.

**REFERENCES:**

1. Wootton, R., Craig, J., Patterson, V. (Eds.), "Introduction to Telemedicine. Royal Society of Medicine" Press Ltd, Taylor & Francis 2006
2. O'Carroll, P.W., Yasnoff, W.A., Ward, E., Ripp, L.H., Martin, E.L. (Eds), "Public Health Informatics and Information Systems", Springer, 2003.
3. Ferrer-Roca, O., Sosa - Iudicissa, M. (Eds.), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54, 2002.
4. Simpson, W. Video over IP. A practical guide to technology and applications. Focal Press Elsevier, 2006.
5. Bemmel, J.H. van, Musen, M.A. (Eds.) Handbook of Medical Informatics. Heidelberg, Germany: Springer, 1997.
6. Mohan Bansal, "Medical Informatics", Tata McGraw-Hill, 2004.

**15 EBM 106 NANO ELECTRONICS 3 1 0 3**

**Course Objective:** To introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems.

**UNIT- I INTRODUCTION TO QUANTUM MECHANICS 12**

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

**UNIT- II SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS 12**

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

**UNIT- III SYSTEMS WITH TWO AND MANY DEGREES OF FREEDOM 12**

Two level systems with static and dynamic coupling, problems in more than one dimensions, electromagnetic field quantization, density of states.

**UNIT- IV STATISTICAL MECHANICS** **12**

Basic concepts, microscopic, quantum systems in equilibrium, statistical models applied to metals and semiconductors.

**UNIT- V APPLICATIONS** **12**

Hydrogen and Helium atoms, electronic states, Atomic force microscope, Nuclear Magnetic Resonance, carbon nanotube properties and applications.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: Explains Basics of quantum mechanics and applications.
CO2: Describes the theories and derivations of quantum mechanics
CO3: Description of Application of quantum mechanics in harmonic oscillators.
CO4: Explains different methods of approximation applications in mechanics.
CO5: Lists the coupling and quantisation techniques with the degrees of the system.
CO6: Describes the basic concepts of statistical mechanics and models applied to substances.
CO7:Lists the Application of Nano electronics in different states

**TEXT BOOKS:**

1. Hagelstein, Peter L., Stephen D. Senturia, and Terry P. Orlando, "Introduction to Applied Quantum and Statistical Physics", New York, NY: Wiley, 2004.
2. Rainer Waser, "Nanoelectronics and Information Technology", Wiley 2005.
3. Michael A. Nielsen and Isaac L. Chuang, "Quantum Computation and Quantum Information", Cambridge University Press, 2000.

**REFERENCES:**

1. Neil Gershenfeld, "The Physics of Information Technology", Cambridge University Press, 2000.
2. Adrian Ionesu and Kaustav Banerjee eds. "Emerging Nanoelectronics: Life with and after CMOS" Vol I, II, and III, Kluwer Academic, 2005

**15 EBM 107 HOSPITAL MANAGEMENT 3 1 0 3**

**Course Objective:** To teach the studentsthe principles, practices and areas of application in Hospital management.

**UNIT - I**

**OVERVIEW OF HOSPITAL ADMINISTRATION** **12**

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 IN HOSPITAL** **12**

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 12**

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 12**

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.

**UNIT- V**

**QUALITY AND SAFETY ASPECTS IN HOSPITAL 12**

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 L + 15 T= 60 h**

**Course Outcome**

CO1: The students will be able to know the current challenges faced in the hospital administration.

CO2: The students will be able to understand the importance and powers of human resource management in hospitals.

CO3: The students will be able to apply the various marketing strategies and its behaviour to estimate consumer and research management.

CO4: The student will be able to design the hospital information system and design various support systems of the hospital departments.

CO5: The student will be able to implement the various safety precautions followed in hospitals and the health insurance policies are studied to ensure the policy nature of hospital and patients.

CO6: The student will be able to understand the rules and procedures for recruiting, training, staffing, leadership in hospitals

**TEXT BOOKS:**

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI – Fourth Edition, 2006 (Units I, II & III).

2. G.D.Kunders, "Hospitals – Facilities Planning and Management – TMH, New Delhi – Fifth Reprint 2007 (Units III, IV & V).

**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 Aspen Publication Inc. Rockville, Maryland, USA, 1990.

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. 1988.
5. Blane, David, Brunner, “Health and SOCIAL Organization: Towards a Health Policy for the 21st Century” Eric Calrendon Press 2002.
6. Arnold D. Kalcizony & Stephen M. Shortell, “Health Care Management”, 6th Edition Cengage Learning, 2011.

**15 EBM 108 REHABILITATION ENGINEERING 3 1 0 3**

**Course Objective:** To teachthe basic concepts of rehabilitation engineering and assist devices and to understand the importance of biomedical engineering in rehabilitation, to learn the design of Wheel Chairs and other assist devices.

**UNIT- I INTRODUCTION TO REHABILITATION ENGINEERING 12**

Introduction to Rehabilitation Engineering - PHAATE model - Clinical practice of rehabilitation Engineering - Low technology tools - Service delivery – Universal design - Design based on human ability - Standards for assistive technology - Test for best design.

**UNIT- II WHEEL CHAIR 12**

Seating Assessment - Interventions in seating system - Biological aspects of tissue health - Support surface classification - Manual wheelchairs – Electric power wheelchairs - Power assisted wheelchairs - Wheel chair standards & tests - Wheel chair transportation.

**UNIT - III ORTHOTIC & PROSTHETIC DEVICES 12**

Anatomy of upper & lower extremities - Classification of amputation types, Prosthesis prescription - Components of upper limb prosthesis - Fabrication of prosthesis - Components of lower limb prosthesis – Orthoses: It”s need and types - Lower extremity- and upper extremity- orthoses - Slints – materials used .

**UNIT- IVASSISTIVE TECHNOLOGY FOR VISION & HEARING 12**

Anatomy of eye, Categories of visual impairment - Cortical & retinal implants - Auditory Information Display - Blind mobility aids – reading writing & graphics access, Orientation & navigation Aids - Anatomy of ear – hearing functional assessment - Surgical and non surgical hearing aids - Assistive technologysolutions for hearing Tactile - Information Display.

**UNIT -V ADVANCED APPLICATIONS 12**

Functional Electrical stimulation - Robots in rehabilitation - Rehabilitation in sports -Daily living aids - Assistive technology for dyslexia - Computer & internet access for challenged people - Neural engineering in rehabilitation engineering - Role of biomedical engineering in rehabilitation.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: The students will be able to select the appropriate rehabilitation concept for various disabilities.

CO2: The students will understand the knowledge of various standards for assistive technology.

CO3: The students will be able to select the appropriate prostheses for the amputation.

CO4: The students will be able to select the appropriate orthotics for the disabled body parts.

CO5: The students will acquire the knowledge of wheel chair and can able to select the appropriate wheel chair for the disabled.

CO6: The students will get the knowledge of various wheel chair standards and test procedures.

CO7: The students will understand the usage of robotics in rehabilitation.

CO8: The students will get knowledge on navigation and assistive aids for the disabled people.

CO9: The students will get the knowledge on selecting the appropriate assistive aids for the disabled peoples.

**TEXTBOOKS:**

1. Rory A, Cooper, Hisaichi Ohnabe, Douglas A, Hodson, "An Introduction to Rehabilitation Engineering",CRC Press, First edition, 2006.

**REFERENCES:**

1. Marion A Hersh, Michael A, Johnson, "Assistive Technology for Visuallyimpaired and blind people", Springer Publications, First edition, 2008.

2. Suzanne Robitaille, "The illustrated guide to Assistive technology and devices–Tools and gadgets for living independently", Demos Health Newyork, First edition, 2010.

**15 EBM 109 TROUBLESHOOTING OF MEDICAL INSTRUMENTS 3 1 0 3**

**Course Objective:** To provide knowledge to students to enable them to troubleshoot the various equipments used in hospitals. To provide adequate technical information on operating principles of medical instruments to attain mastery in fault detection and corrective measures.

**UNIT- I FUNDAMENTAL TROUBLESHOOTING PROCEDURES 12**

Making of an Electronic Equipment, causes of Equipment Failure, Troubleshooting Process & Fault finding Aids, Troubleshooting Techniques, Grounding Systems in Electronic Equipment, Temperature Sensitive Intermittent Problems, and Correction Action to repair the Equipment.

**UNIT- II TESTING OF PASSIVE COMPONENTS & SEMICONDUCTOR DEVICES 12**

Testing: resistors, capacitors & inductors, causes of failure for electronic components, testing procedure for semiconductor devices: special diodes, bipolar transistors, field effect transistor (FET), and thyristor.

**UNIT- III FAULT DIAGNOSIS IN ANALOG& DIGITAL INTEGRATED CIRCUITS 12**

Fault Diagnosis in Op-Amp Circuits, Digital Troubleshooting Methods, Digital IC Troubleshooters, Circuit board Troubleshooting.

**UNIT- IV BIOMEDICAL EQUIPMENT TROUBLESHOOTING –I 12**

Trouble shooting of ECG Machine, EEG Machine, Defibrillator Electrosurgical unit, Anaesthesia machine, Autoclaves & sterilizers, Endoscope.

**UNIT -V BIOMEDICAL EQUIPMENT TROUBLESHOOTING –II 12**

Troubleshooting of Incubators, Nebulizer, Oxygen Concentrators, Oxygen cylinders & flow meters, PulseOximeter, Sphygmomanometers, SuctionMachine, X-RayMachine .

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: Identifies the basic equipment failure and troubleshooting techniques.
CO2: Performs testing procedures and detects the electronic component failure.
CO3: Implementation of the failure correction and troubleshooting methods.
CO4: Fault identification in the integrated circuits of the equipment.
CO5: Describes the procedure for troubleshooting various biomedical equipments.
CO6: Application of the failure correction techniques different biomedical equipments like incubator, nebulizer, flow meters and X-ray machine.

**TEXTBOOKS:**

1. Khandpur R S, "Troubleshooting Electronic Equipment- Includes Repair &Maintenance", Tata McGraw-Hill, Second Edition 2009.
2. Dan Tomal & Neal Widmer, "ElectronicTroubleshooting", McGraw Hill, 3rd Edition 2004.

**REFERENCES:**

1 Nicholas Cram & Selby Holder, "Basic Electronic Troubleshooting forBiomedical Technicians", TSTC Publishing, 2nd Edition 2010.
2 World Health Organisation, "Maintenance & Repair of Laboratory, Diagnostic imaging & Hospital Equipment", Geneva,1994.
3 Ian R, McClelland , "X-ray Equipment maintenance & repairs workbook for Radiographers& Radiological Technologists", World Health Organisation, Geneva, 2004.
4 Ministry of Health & Family Welfare, "Medical Equipment Maintenance Manual- A first line maintenance guide for end users", New Delhi, October 2010.
5 Joseph.J, Panichello, "X-Ray Repair: A Comprehensive Guide to the Installation & Servicing of Radiographic Equipment", Charles C Thomas Publisher Ltd, 2nd Edition 2005.

**15 EBM 110 ADVANCED MEDICAL IMAGING SYSTEMS 3 1 0 3**

**Course Objective:** To introduce the students to advanced medical imaging techniques enabling the students to work professionally in the biomedical engineering sector and other medical imaging related industry in designing systems, components, products or processes to meet desired needs of these industries in health care wing.

**UNIT - I FLUOROSCOPY** **12**

Fluoroscopic imaging chain components - Characteristics of Image intensifier performance - Modes of operation - Image quality - Radiation dose – Fluoroscopic suites - Peripheral equipment - Optical coupling - Video cameras.

**UNIT- II COMPUTED TOMOGRAPHY** **12**

Basic Principles - Geometry and Historical Development - Detectors and Detector Arrays - Details of Acquisition - Tomographic Reconstruction - Digital Image Display - Radiation Dose, Image Quality – Artifacts – Optical Tomography.

**UNIT - III fMRI** **12**

Introduction to fMRI - Basics of MRI Signal, Tissue contrast and spatial localization - Neuronal activity and Hemodynamics - BOLD fMRI - SNR in fMRI - Experimental design - fMRI statistics 1and 2 - Advanced fMRI.

**UNIT- IV MICROWAVE AND INFRARED IMAGING** **12**

Introduction, Electromagnetic scattering - Elecromagnetic inverse scattering problem - Imaging configuration - Model approximations – Qualitative reconstruction methods - Microwave imaging apparatus - Infrared imaging- Thermography - Clinical applications of thermography - liquid crystal thermography.

**UNIT -V RADIO ISOTOPE IMAGING AND NUCLEAR MEDICINE** **12**

Radio nuclides for imaging: Cyclotron-, Nuclear reactor-, and Generator production – Rectilinear-, and linear scanners- SPECT- PET - Gamma Camera - Comparison of tomographic techniques - Radiation dosimetry- Radiation protection.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1: Describes the basic principles and characteristic properties of fluoroscopic imaging.
CO2: Explains the principles, detector types and reconstruction techniques in computed tomography.
CO3: Description of complete functioning and imaging procedures for fMRI.
CO4: Lists the imaging principles of different electromagnetic radiations such as microwave and infrared.
CO5: Describes applications of infrared imaging in medicine.
CO6:Explains the different nuclear imaging techniques with principle and mechanism.
CO7: Lists the radiation effects and dosage levels produced by all the radiation based imaging techniques.

**TEXTBOOKS:**

1. Khandpur R S, *"*Hand-book of Biomedical Instrumentation*",* Tata McGraw Hill, 2nd Edition, 2003.
2. William Hendee R, Russell Ritenour E, "Medical imaging physics", Fourth Edition, 2002.

**REFERENCES:**

1. Stephan Ulmer, Olav Jansen, "FMRI: Basics and Clinical Applications*",* Springer, first Edition,2010.
2. Matteo Pastorin , "Microwave imaging*",* John Wiley and Sons ,first edition , 2010.

**15 EBM 110 ADVANCED DIAGNOSTIC AND SURGICAL EQUIPMENTS 3 1 0 3**

**Course Objective:** To study ICU equipments, neonatal equipments and safety measures for bio medical equipments and to give a complete exposure to working of advanced surgical and diagnostic lab equipments.

**UNIT- I**

**ICU EQUIPMENTS AND NEONATAL EQUIPMENT 12**

Oxygen concentrators – Capnographs monitoring systems - cardiac monitor, multipara monitor - Advanced defibrillators –internal and external – Intermediate level of suction apparatus – Laryngoscope - Advance level of radiant warmer, phototherapy units - Doppler fetal heart rate device (handheld type), Fetal Tocography - C.T.G, Baby Incubator, Neonatal ventilator.

**UNIT- II**

**DIAGNOSTIC NEUROLOGICAL EQUIPMENTS 12**

Stereo toxic unit- depth recording system-dot scanners- transcutaneous nerve Stimulator-anesthesia monitor - EEG controlled anesthesia- bio-feedback equipments, Spinal reflex measurements.

**UNIT- III**

**DIAGNOSTIC LAB EQUIPMENTS 12**

Basic Blood gas analyzer - Photo meter and spectro photometer - Microtome, osometer, Lab freezer - PH meter, Optical microscope - Water bath types, Centrifuge (table), Shakers, Lab, laminar air flow units - Lab precision balances, Pippets, Washers, Incubator and Heating unit centrifuge (Flour) – Electrophoresis systems, tissue embedding equipment - Ambulance setup.

**UNIT - IV**

**SURGICAL EQUIPMENTS 12**

Electrosurgical units, Warmer (Blood and Patient) - tourniquet, insufflators, irrigation unit - Operating microscope - arthroscopic, Operation Theater (OT): Lights, and Patient"s tables - Flow meters (gas & blood), sterilizing units (auto clave), Surgical driller - Sterilizing producers, manifold unit – Central supply of air.

**UNIT- V**

**SURGICAL SCOPY AND DIATHERMY EQUIPMENTS 12**

Laparoscope, Gastro scope, endoscopes -light sources. Bronchoscope: Video processors, Camera, and Fiber optic cable. Depth of penetration and physiological effects of H.F. radiation- Short wave-Ultra Sonics and Microwave diathermy- Surgical diathermy, physiological effects of stimulation, galvanic, Faradic and surged types, interferential therapy.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: To study equipment used in Intensive Care Unit and all monitoring devices and assistive devices designed for neonatal care.
CO2: Understand diagnostic equipment used for neurological disorders.
CO3: Give a complete exposure to working of advanced diagnostic lab equipment

CO4: Provide detailed information regarding parts and working of all surgical scope.
CO5: Aware of requirements needed in operation theatre such as equipment for surgery and sterilization and central gas supply outlets.
CO6: Familiarized with general diathermy machine used in surgery and the different types depend on application areas.

**TEXTBOOKS:**

1. Albert M, Cook and Webster J G, "Therapeutic Medical Devices", Prentice Hall Inc., New Jersey, 1982.
2. Geddes L A and Baker L E, "Principles of Applied Biomedical Instrumentation", John Wiley, 3rd Edition, 1975, Reprint 1989.
3. Khandpur R S, "Hand-book of Biomedical Instrumentation", Tata McGraw Hill, 2nd Edition, 2003.

**REFERENCES:**

1. Leslie Cromwell, Fred J, Weibell, Erich A, Pfeiffer, "Biomedical Instrumentation and Measurements", Prentice-Hall India, 2nd Edition,1997.
2. John G, Webster, "Medical Instrumentation application and design", JohnWiley, 3rd Edition, 1997.
3. Fein Berg B N, "Applied Clinical Engineering", Prentice Hall Inc., New Jersey, 1986.

**15 EBM 111 DESIGN AND DEVELOPMENT OF MEDICAL DEVICES 3 1 0 3**

**Course Objective:** This course will introduce students with basics of design, construction and development process of devices which are used in medical, clinical or laboratory practice.

**UNIT- I**

**INTRODUCTION TO MEDICAL DEVICE 12**

Define medical device, Classification of medical device, Medical device vs medical instrumentation, Origin of bio-potential, Physiological signal, Human machine interface ,Input output and control signal, Data acquisition, Sensor, Amplification, Medical electrical stimulator.

**UNIT- II**

**MINIMALLY INVASIVE DEVICE AND TECHNIQUE 12**

Laparosopic instrumentation, surgical instrumentation in ophthalmology - Phacoemulsification: Instrument and system - Vitrorectomy: Instrument and system- Human machine interface.

**UNIT- III**

**SYSTEM DESCRIPTION OF DIAGNOSTIC EQUIPMENT 12**

Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

**UNIT- IV**

**SYSTEM DESCRIPTION OF THERAPEUTIC EQUIPMENT 12**

Pacemaker, External cardiovector defibrillator, Implantable cardiovector defibrillator, Deep brain stimulation , Functional electrical stimulator (FES), Hemodialysis delivery system, Mechanical ventilator.

**UNIT -V**

**SYSTEM DESCRIPTION OF VARIOUS IMPLANT AND PROSTHESIS 12**

Total hip prosthesis, Joint replacement, Design of artificial pancreas, Drug eluting stent and its engineering design - Intraocular lens implant, Cochlear implants, Heart valves.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: Understand the basics of design, construction and development process of devices which are used in medical, clinical or laboratory practice.
CO2: Able to identify all types of medical devices and the working of main parts coming under each medical device.
CO3: Have the idea of design of minimally invasive medical devices and the thorough understanding of its instrumentation.
CO4: Familiarized with techniques and components in design process of all diagnostic equipments.
CO5: Have a basic understanding of therapeutic equipment in design and delevopment.
CO6: Developed the knowledge in design of various implants and prosthesis.

**TEXTBOOKS:**

1. Gail Baura, "Medical Device Technologies: A Systems Based Overview Using Engineering**",** Elsevier science, 2002.
2. Martin Culjat, Rahul Singh, Hua Lee, "Medical Devices: Surgical and Image-Guided Technologies", John Wiley & Sons, Reinaldo perez, "Design of medical electronic device", Elsevier science, 2002.
3. Richard C, Fries, "Handbook of Medical Device Design", Marcel Dekker AG, 2nd edition 2005.

**REFERENCES:**

1. Anthony Y. K, Chan, "Biomedical device technology: principles and design", Charles Thomas, 2008.
2. Theodore R, Kucklick, "The Medical Device Ramp-D Handbook",Taylor &Francis Group LLC, 3rd edition 2013.
3. David Prutchi, Michael Norris, "Design and Development of Medical Electronic Instrumentation: A Practical perspective of the design, construction and test of medical devices", John Wiley & Sons, 2005.

**15 EBM 112 BIOMEDICAL MEMS AND NANOTECHNOLOGY 3 1 0 3**

**Course Objective:** To enable the students to acquire knowledge about the principles & application of BioMEMS & Biomedical Nanotechnology. To understand the working principle of MEMS & Microsystems.

**UNIT - I**

**MEMS & MICROSYSTEM** **12**

MEMS and Microsystems- Introduction - Typical MEMS and Microsystem Products - Application of Micro-system in Healthcare Industry – Working Principles of Microsystems Micro-sensors – Micro-actuation - MEMS with Microactuation – Micro-accelerators & Micro-fluidics - Materials for MEMS & Microsystems.

**UNIT - II** **12**

**MICRO-OPTO ELECTROMECHANICAL SYSTEMS & MICROFLUIDICS**

Fundamental principle of MOEMS Technology - Light Modulators, Beam splitter – Micro-lens, Micro-mirrors - Digital Micro-mirror Device, Light detectors - Important Consideration on Micro-scale fluid, Properties of fluid - Fluid Actuation Methods – Micro-pumps - Typical Micro-fluidic Channel, Micro-fluid Dispenser.

**UNIT- III**

**BIOMEMS** **12**

BIOMEMS-Introduction, the driving force behind the biomedical Application - Principle of Biosensor, Ampero-metric Biosensor - Multi-analyte measurement, Micro-dialysis - BioMEMS for Clinical Monitoring - Multi-parameter monitoring - Monitoring of Glucose & Lactate with a micro-dialysis probe – Ammonia Monitoring - Electronic Nose, DNA Sensors.

**UNIT- IV**

**DNA BASED BIOMEMS** **12**

Introduction, Unique features of Nucleic Acids,Lab on the Chip, Electrophoresis, Polymerase Chain Reaction (PCR), Biochemical reaction chains for integration: Biosensors & the "lab biochip", Typical Microarray experiment, Manufacturing of Microarrays, Synthesis on the chip, Spotting Techniques, PCR on the chip, Microchamber Chips, Micro-fluidics Chips, Emerging BioMEMS Technology.

**UNIT -V**

**BIOMEDICAL NANOTECHNOLOGY** **12**

Introduction to nanoscale phenomena, Nanoparticles- Nanomaterial characterization – XRD, SAXS, TEM, SEM, Scanning Tunneling microscopy, AFM, SPM technique, Biomolecular sensing for cancer diagnostics using carbon nanotubes, Carbon nanotube biosensors, Magnetic nanoparticles for MR Imaging, Nano-devices in biomedical applications.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: The students will get adequate understanding and implementations about the integration of mechanical and electrical elements and also the techniques involved in the fabrication of biomems and nanotechnology.

CO2: It provides an ability to apply interdisciplinary principles from chemistry and biology, materials and mechanics, and micro-nano-fabrication to Bio-MEMS.

CO3: A basic knowledge of BioMEMS processing steps and processing modules.

CO4: An understanding of basic design and operation of BioMEMS sensors and transducers, and Biochips

CO5: Describe the fundamental principles of bio molecule sensors and applying knowledge to design solutions to probe biomedical and biology systems.

CO6: Demonstrate a detailed understanding of the fundamental principles of nanotechnology and their application to biomedical engineering.
CO7: Analyse the fabrication of microfluidic devices,surface functionalization and the limitations of surface micromachining.
CO8: Evaluate and employ electrical measurements for MEMS mechanical structure characterization, understanding possible problems encountered in living systems.

**TEXTBOOKS:**

1. Steven S, Saliterman, "Fundamentals of BioMEMS & Medical Microdevices*",*International Society for Optical Engineering, First Edition 2006.
2. Nitaigour Premchand Mahalik, "MEMS", Tata McGraw Hill, 2nd Reprint 2008.
3. Wanjun Wang & Steven A.Soper , "BioMEMS- Technologies and applications", CRC Press, First edition 2007.

**REFERENCES:**

1. Tai-Ran Hsu, "MEMS & Microsystems- Design, Manufacture and Nanoscale Engineering*"*, John Wiley & Sons, 2nd Edition 2008.
2. Gerald A Urban, "BioMEMS*",* Springer, First Edition 2006.
3. Abraham P. Lee and James L. Lee, "BioMEMS and Biomedical Nanotechnology", Volume I, Springer, First Edition 2006.
4. Paul C.H. Li, "Introduction to Microfluids and BioMEMS: A Design and Problem-SolvingTextbook", CRC Press, First Edition 2009.
5. Hari Singh Nalwa, "Nanostructured Materials and Nanotechnology", Academic Press, First Edition 2002.
6. Guozhong Cao & Ying Wang, "Nanostructures and Nanomaterials-Synthesis, Propertiesand Applications*",* World Scientific, 2nd Edition 2011.

**15 EBM 114 HUMAN ASSIST DEVICES 3 1 0 3**

**Course Objective:** The student should be made to study various mechanical techniques that will help failing heart, learn the functioning of the unit which does the clearance of urea from the blood. Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss. Know the various orthodic devices and prosthetic devices to overcome orthopaedic problems. Understand electrical stimulation techniques used in clinical applications.

**UNIT- I CARDIAC ASSIST DEVICES 12**

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

**UNIT- II HEMODIALYSERS 12**

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

**UNIT- III HEARING AIDS 12**

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

**UNIT- IV PROSTHETIC AND ORTHODIC DEVICES 12**

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

**UNIT - V**

**RECENT TRENDS 12**

Transcutaneous electrical nerve stimulator, bio-feedback.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1: Familiarized with all types of human assist device and its operations.
CO2: Studied various mechanical techniques that will help failing heart by means of cardiac assist devices.
CO3: Learned the functioning of hemodialyser which does the clearance of urea from the blood.
CO4: Understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
CO5: Know the various orthotics devices and prosthetic devices to overcome mobility problems faced by disabled persons.
CO6: Understand electrical stimulation techniques used in clinical applications.

**TEXT BOOKS:**

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

**REFERENCES:**

1. D.S. Sunder, "Rehabilitation Medicine", 3rd Edition, Jaypee Medical Publication, 2010.

**15 EBM 114 FIBER OPTICS AND LASERS IN MEDICINE 3 1 0 3**

**Course Objective:** Thestudent should become familiar with objective property of tissues, be exposed to Optical Holography.

**UNIT- I OPTICAL PROPERTIES OF THE TISSUES 12**

Refraction, scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

**UNIT- II INSTRUMENTATION IN PHOTONICS 12**

Instrumentation for absorption, scattering and emission measurements, excitation light sources – highpressure arc lamp, solid state LEDs, optical filters, polarisers, time resolved and phase resolved detectors.

**UNIT- III APPLICATIONS OF LASERS 12**

Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

**UNIT - IV OPTICAL HOLOGRAPHY 12**

Wave fronts, interference patterns, principle of hologram, optical hologram, applications.

**UNIT- V SPECIAL TECHNIQUES** **12**

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

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcome:**

CO1:Familiarized with objective property of tissues, be exposed to Optical Holography.
CO2:Have a basic understanding of optical nature of tissue for the application in medical field.
CO3:Basic knowledge of instrumentation in Bio photonics.
CO4:Study application of lasers in various biomedical fields.
CO5:Familiarized with principle and operation of holography and its application in medical imaging.
CO6:Able to identify different imaging of biological structures by near field techniques.

**TEXT BOOKS:**

1. Leon Goldman, M.D., & R.James Rockwell, Jr., "Lasers in Medicine", Gordon and Breach, Science Publishers Inc., 1975.
2. Abraham Katzir, "Lasers and Optical Fibers in Medicine", Academic Press Edition,1998.

**REFERENCES:**

1. Tuan Vo Dirh, "Biomedical Photonics – Handbook", CRC Press, Bocaraton,2003 (Unit I – III, V)
2. Glasser, O., "Medical Physics -- Vol 1, 2, 3 "Adam Hilgar Brustol Inc, 1987.
3. G.David Baxter "Therapeutic Lasers – Theory and practice", Churchill Livingstone Publications Edition- 2001.

**15 EBM 115 NEURAL ENGINEERING 3 1 0 3**

**Course Objective:** The student should be made to be familiar with the nervous system development, exposed to neuronal diseases and disorders, be familiar with nerve reconstruction and repairing.

**UNIT- I**

**BASICS OF NEURON STRUCTURE AND FUNCTIONS** **12**

Nervous system development. Trophic factors, extra cellular matrix components in nervous system development. Neuron: structure – function – classification. Glial cells – myelination – Neurotransmitter – types and functions. Synapses - Transport of materials and impulse in neurons; Blood Brain barrier.

**UNIT- II**

**BRAIN, BRAIN STEM AND SPINAL CORD** **12**

Brain: structures – lobes – functional areas. Brain stem: structures – functional areas. Spinal cord:structure – functions. Concepts of nuclei – Tracts - Reticular formation. Blood supply of Brain and spinal cord**.**

**UNIT- III**

**NEUROPHYSIOLOGY & NEURORADIOLOGY 12**

Physiology of nerve conduction. Peripheral nerves – structure & Functions. Synaptic transmission and cellular signaling of Neurons. Electrical activity of the Brain and recording of brain waves. Evoked potentials. Visualization of nervous system.

**UNIT - IV**

**NEURONAL DISEASES AND DISORDERS 12**

Neuro degeneration: Degenerative, Demyelinated and injury related disorders associated with nervous system. Wallerian Degeneration. Neuronal plasticity –CNS acting drugs and their pharmacokinetics.

**UNIT- V NERVE RECONSTRUCTION AND REPAIRING 12**

Regeneration of the nervous system. Nerve graft; Neural tissue engineering; Drug delivery system in CNS. Cognitive & neurobehavioral rehabilitation.

**TOTAL: 45 L + 15 T= 60 HOURS**

**Course Outcomes:**

CO1:Lists the basic anatomy and physiology of brain and spinal cord.
CO2:Describes the basic structure and function of the neuron
CO3:Explains Neurophysiology which involves the electrical activity of brain and neural structures.
CO4:Description of Neuroradiology of brain and nervous system.
CO5:Lists the various types of neural degenerative diseases.
CO6: Explains neuroplasticity related with the drugs and pharmacokinetics reacting with CNS.
CO7 :Describes the regeneration of the nervous system.
CO8: Description of cognitive and neurobehavioral rehabilitation used in repairing nerve damages.

**TEXT BOOKS:**

1. Mathews G.G. “Neurobiology”, 2nd edition, Blackwell Science, UK, 2000.
2. Malcom Carpenter, “Neuroanatomy”, Mc Graw Hill 4th Edition.1991.

**REFERENCES:**

1. W. Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue –- Oxford University Press Inc New York 2004.
2. Park J.B., “Biomaterials Science and Engineering”, Plenum Press, 1984.

# Syllabus Generic Elective Courses

**15 EBM 151 COMPUTATIONAL FLUID DYNAMICS ANALYSIS IN MEDICINE 3 0 0 3**

**Course Objective:** To enable the students to acquire knowledge about Computational Fluid Dynamics which is useful in analysis & design of various fluid flow medical devices, to understand the fundamentals of fluid dynamics, the importance of CFD and numerical methods. To get an insight into FEM, FDM & FVM and know about the application of CFD in biomedical domain.

**UNIT- I**

**BASIC CONCEPTS & FUNDAMENTALS OF FLUID DYNAMICS 9**

Definition & properties of fluids and classification of fluids, Introduction to fluid statics & kinematics, Governing Equations of fluid motion: Langragian & Eulerian description, Reynolds transport theorem, Integral & differential forms of governing equations: mass, momentum & energy conservation equations, Euler"s Equation, Bernoulli"s Equation, Navier-Stokes equations.

**UNIT - II**

**INTRODUCTION TO CFD & OVERVIEW OF NUMERICAL METHODS 9**

Computational fluid dynamics (CFD): What, When & Why, CFD Applications, Classification and Overview of Numerical Methods: Classification into various types of equation; parabolic elliptic and hyperbolic; boundary and initial conditions; over view of numerical methods, Illustrative examples of elliptic, parabolic and hyperbolic equations.

**UNIT- III**

**INTRODUCTION TO FEM, FDM & FVM 9**

Finite element method (FEM) - Finite difference method (FDM)- Finite volume method (FVM) – Its application in medicine.

**UNIT- IV**

**FUNDAMENTALS OF DISCRETIZATION 9**

Discretization principles: Pre-processing, Solution, Post-processing, Finite Element Method, Finite difference method, Well posed boundary value problem, Possible types of boundary conditions, Conservativeness, Boundedness, Transportiveness, Finite volume method (FVM), Illustrative examples: 1-D steady state heat conduction without and with constant source term, Comparison of Discretization techniques.

**UNIT- V**

**CFD IN MEDICINE 9**

Examples of Biomedical CFD applications, Case Study-1: Respiratory flow in a bifurcation-Case Study-2: CFD Analysis of blood pump - Case Study-3: Computational model of blood flow in the aorta-coronary bypass graft.

**TOTAL : 45 HOURS**

**Course Outcomes:**

CO1: Describes the basic concepts, theories and fundamentals of fluid dynamics.

CO2: Explains the applications of computational fluid dynamics.

CO3: Lists the various techniques described in numerical methods.

CO4: Describes finite element, finite difference and finite volume methods and its applications in medicine.

CO5:Describes the fundamentals of discretization with illustrative examples.

CO6: Lists the Applications of CFD in Biomedical field.

**TEXTBOOKS:**

1. Robert W, Fox, Philip J, Pritchard, Alan McDonald T "Introduction to Fluid Mechanics", John Wiley & Sons, Seventh Edition 2009.
2. Frank M, White, "Fluid Mechanics", Tata McGraw-Hill, Singapore, Sixth Edition, 2008.
3. Goldstein J, Richard, "Fluid Mechanics Measurements", Taylor & Francis Publication, Second Edition 1996.

**REFERENCES:**

1. Chung T J, "Computational Fluid Dynamics*",* Cambridge University Press, 2nd Edition 2010.
2. John D, Anderson, Jr, "Computational Fluid Dynamics The Basics with Applications*",* Tata Mcgraw Hill, First Edition 2012.
3. Blazek J, "Computational Fluid Dynamics: Principles & Applications*",*Elsevier, 1st Edition 2001.
4. Ferziger J H & Peric M, "Computational Methods for Fluid Dynamics",Springer, 3rd Edition 2002.
5. Versteeg H K, & Malalasekara W, *"*Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearson Education, 2nd Edition 2008.
6. Shaw C T, "*Using Computational Fluid Dynamics",* Prentice Hall, First Edition 1992.

**15 EBM 152 ROBOTICS AND AUTOMATION IN MEDICINE 3 0 0 3**

**Course Objective:** To provide the basic knowledge on design, analysis, control and working principle of robotics in surgery, rehabilitation and drug delivery (Nano robot).
To study about the basic concepts of robots and types of robots, study about manipulators, actuators and grippers, various types of sensors and power sources and to study the various applications of robot in the medical field.

**UNIT- I INTRODUCTION OF ROBOTICS 9**

Introduction to Robotics and its history, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Automation, Mechanisms and movements, Dynamic stabilization- Applications of robotics in medicine.

**UNIT- II ACTUATORS AND GRIPPERS 9**

Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, Design consideration in vacuum and other methods of gripping, PD and PID feedback actuator models.

**UNIT- III MANUPULATORS & BASIC KINEMATICS 9**

Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems.

**UNIT- IV POWER SOURCES AND SENSORS 9**

Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors, laser range finder, variable speed arrangements, Path determination - Machinery vision, Ranging – Laser- Acoustic, Magnetic fiber optic and Tactile sensor.

**UNIT - V ROBOTICS IN MEDICINE 9**

Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric-, and General- Surgery, Gynecologic Surgery, General Surgery and Nano robotics.

**TOTAL: 45 HOURS**

**Course outcome:**

The students will :
CO1: Gainthe basic knowledge on designanalysis, control and working principle of robotics
CO2: Understand the basic concept of robots and types of robots
CO3: Acquire information about the manipulators, actuators, grippers and control forces in robotics
CO4:Understand the various types of sensors and power sourcesused in a robot
CO5:Gain knowledge about various applications of robot in the medical field- surgery, rehabilitation and drug delivery (Nano robot).

**TEXTBOOKS:**

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill, First edition, 2003.
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008.
3. Fu.K.S, Gonzalez.R.C., Lee, C.S.G, "Robotics, control", sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008.

**REFERENCES:**

1. Howie Choset, Kevin Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki and Sebastian Thurn, "Principles of Robot Motion:Theory, Algorithms, and Implementations", Prentice Hall of India, First edition, 2005.
2. Philippe Coiffet, Michel Chirouze, "An Introduction to Robot Technology", Tata McGraw-Hill, First Edition, 1983.
3. Jacob Rosen, Blake Hannaford & Richard M Satava, "Surgical Robotics:SystemApplications & Visions", Springer 2011.
4. http://www.lapsurg.com.br/arquivos/books/medical_robotics12402am02010 0000000.pdf

5. Barbara Webb and Thomas Consi. R, "BioRobotics: Methods & Applications", Barbara Webb and Thomas Consi. R, AAAI Press/MIT Press, First Edition, 2001.
6. Constantinos Mavroidis, Antoine Ferreira, "Nanorobotics: Current approaches and Techniques" , Springer 2011.

**15 EBM 153 BIOPHOTONICS 3 0 0 3**

**Course Objective:**

To impart adequate knowledge on various optical systems used in sensing and imaging of biological elements. To educate about the various interaction mechanisms of light with matter, make them understand the working principles of optical imaging systems and provide an insight to various biosensors

**UNIT- I**
**LIGHT - MATTER INTERACTION & PRINCIPLE OF OPTICS 9**
Light matter interaction: Interaction of light with bulk matter- Types of spectroscopy: Electronic absorption-, Electronic luminescence-, Vibration-, and Fluorescence-spectroscopy.

**UNIT- II**
**BIO-IMAGING: PRINCIPLES AND TECHNIQUES 9**
Introduction of optical imaging, Types of microscopy: Transmission-,Fluorescence-, Scanning- and Multi-photon- microscopy- Advantages and disadvantages of optical imaging- Applications of optical imaging.
.

**UNIT - III**
**OPTICAL BIOSENSORS 9**
Principles of Optical biosensing, Immobilization of bio-recognition elements, Types of optical biosensor: Fiber optic-, Planar waveguide-, Evanescent-,Interferometric-, and Surface plasmon resonance- biosensor- Advantages and disadvantages- Applications.

**UNIT- IV**
**FLOW CYTOMETRY 9**
Flow cytometry: Basis, Components, and Flourochromes- Data manipulation and Presentation.

**UNIT- V**
**PHOTODYNAMIC THERAPY 9**
Photodynamic therapy: Mechanism, and light irradiation- Photo-hemotheraphy- PUVA Technique- Applications.
**TOTAL: 45 h**
**Course Outcome:**
CO1: The student will gain basic knowledge on applying the optical principles involved in biomedical engineering domain.
CO2: Biophotonics is a multidisciplinary subject. It provides training in the cutting-edge of biology and photonics. It is defined as the science of generating and harnessing light (photons) to image, detect and manipulate biological materials.

CO3: The objective of Biophotonics is to create a platform for students to have deeper understanding on the fundamental principles of light based technologies and biomedical systems. (devices and instruments).
CO4: The subject aims to help students to build up a detailed knowledge of the methods and capability used in the design, fabrication and application of biophotonic systems. After pursuing this subject, it is expected that the students have a clear understanding of the principles of the interface between biology and photonics.
CO5: They will develop a good knowledge on basic photonic concepts.
CO6: It develops a capability of innovation to make design and selection decisions in response to measurement problems amenable to the use of such biophotonic systems.
CO7: The goal of this course is to provide an introduction to the principles of optics and biosensors, the basics of biology, the interaction of light with cells and tissues, and the applications of various optical imaging and sensing techniques in biomedicine.

**TEXTBOOKS:**

1. Jurgen Popp, Valery V, Techin, Arthur Chiou, Stefen Heinemann, "Handbook of Biophotonics Vol 2: Photonics for Health Care", John Wiley & Sons, First Edition, 2012.
2. Paras N, Prasad, "Introduction to Biophotonics", John Wiley & Sons, First Edition, 2003.

**REFERENCES:**

1. Harold Sackman, Brian Wilson, Valeri Viktorovich Tuchin, S. Tanev, Harold Sackman "Advances in Biophotonics", IOS Press, 2005.
2. Paras N Prasad, "Nanophotonics", John Wiley & Sons, First Edition, 2004.

**15 EBM 154 ELECTROPHYSIOLOGY FOR HUMAN SYSTEM 3 0 0 3**

**Course Objective:** The purpose of the course is to understand the concepts and methods of electrical bio physics in the diagnosis and treatment of human diseases, understand the basics of the cell physiology and study about the electro cardiology

**UNIT- I**

**INTRODUCTION TO CELL PHYSIOLOGY 10**

Level of organizing the body-chemical level, cellular level, organ level, organism level-Concept of membrane potential-Membrane potential is separation opposes changes. Electrical field in cells and Organism-Electrical structure of the living organism-extracellular field and currents-passive –action potential-electrical tissue and cell suspension-single cell in external electrical field-manipulation of cell by electric field.

**UNIT- II**

**ELECTRICAL CARDIAC PHYSIOLOGY 9**

Electrical activity of the heart-cardio auto rhythmic display pace maker activity,the action potential of contractile cell-ECG record is record of the overall spread electrical activity through the heart, different part of the ECG record can be correlated specific events, ECG diagnosis the abnormal events-Mechanical events of the cardiac cycle-Cardiac output its control.

**UNIT - III**

**ELECTRICAL MUSCLE PHYSIOLOGY 9**

Molecular basis of the skeletal muscle contraction-Skeletal muscle fibred, myosin forms thick filaments-Muscle mechanics- Group of muscle fiber, types of contraction, EMG motor unit:

EMG conduction motor unit, Muscle motor unit recruitment, Muscles fiber frequency of stimulation- Types of muscles based on the ATP hydrolysis and synthesis.

**UNIT- IV**

**NERVE CONDUCTION** **8**

Nerve impulse-neurotransmitter and synapse- Passive transport and den triesactive transport and Hodgkin-Huxley equation-EEG- neurotransmitter-nerve conduction of EEG signal-Simulation of action potential-excitation threshold, neuronal refractoriness, repetitive spiking-Fitzhugh-Nagumo model-action potential in earthworm nerve fiber.

**UNIT - V**

**PERIPHERAL NERVOUS SYSTEM: SPECIAL SENSE** **9**

Pain-simulation of nociceptors elicits the perception of the pain plus motivational and emotional response. Eye: protective mechanism help of prevent eye injuries light controlled by iris-EOG oculography measure the resting potential of retina. ENG Electronystagmography )-oculomotor evaluation-position testing-caloric simulation of the vestibular system.

**TOTAL: 45 HOURS**

**Course Outcome:**

CO1: Familiarized with the basics of the cell physiology and relation with electric field.
CO2: Have a basic understanding of cardiac physiology and ECG recording from heart.
CO3: Understand the concepts and methods of electrical bio physics in the diagnosis and treatment of human diseases
CO4: Have knowledge of electrical muscle physiology and how it help in EMG recording.
CO5: Studied nerve impulse conduction and relation with EEG recording for the treatment of all brain related diseases.
CO6: Have an idea of peripheral nervous system and study of related diagnostic methods.

**TEXTBOOKS:**

1. Laura lee Sherwood, “Human Physiology from cell to system”, eighth edition,2012.
2. Laura lee Sherwood, “Fundamental of Physiology of Excitable Cells”, 2010.

**REFERENCES:**

1. Lionel Opie, “Heart Physiology” 2009.
2. Aidley, “The Physiology of Excitable Cells”, 3rd/4 the edition, 2008.
Cambridge PressJames Cal Comb, Jonathan Tran “Introductory Biophysics”, 2009.
3. Roland Glaser, “Biophysics an introduction”, Second edition, 2009.

**15 EBM 155 BIOETHICS AND BIOSAFETY 3 0 0 3**

**Course Objectives:** To discuss about various aspects of biosafety regulations, IPR and bioethics concerns arising from the commercialization of biotech products.

**UNIT - I**

**BIOETHICS** **8**

Bioethics – Necessity of Bioethics, different paradigms of Bioethics – National & International.Ethical issues against the molecular technologies.

**UNIT- II**

**BIOSAFETY** **10**

Biosafety– Introduction to biosafety and health hazards concerning biotechnology. Introduction to the concept of containment level and Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP).

**UNIT- III**

**PATENT LAW** **12**

Introduction to Indian Patent Law.World Trade Organization and its related intellectual property provisions.Intellectual/Industrial property and its legal protection in research, design and development.Patenting in Biotechnology, economic, ethical and depository considerations.

**UNIT- IV**

**PATENT OF BIOLOGICAL PRODUCTS** **10**

Detailed information on patenting biological products, Biodiversity, Budapest treaty, Appropriate case studies.

**UNIT -V**

**IPR** **5**

Distinction among various forms of IPR, Requirement of a patentable novelty, invention step and prior art and state of art, procedure.

**TOTAL: 45 HOURS**

**Course outcomes:**

CO1: The students will gain knowledge **in** the study of the ethical issues emerging from advances in biology and medicine. It is also moral discernment as it relates to medical policy and practice.

CO2: This course creates awareness on the Biosafety, Bioethics, Intellectual property rights and patenting of biotechnological processes and products

CO3: Students will gain awareness about Intellectual Property Rights (IPRs) to take measure for the protecting their ideas

CO4: They will be able to devise business strategies by taking account of IPRs .

CO5: They will be able to assists in technology upgradation and enhancing competitiveness.

CO6: They will gain more insights into the regulatory affairs.

CO7: They will acquire adequate knowledge in the use of genetically modified organisms and its effect on human health.

CO8: By the end of the course, the students should be able to: demonstrate good laboratory procedures and practices,describe the standard operating procedures for biotechnology research and assign Biosafety levels,justify the design of confinement facilities at different Biosafety levels,discuss the social and ethical issues related to plant and animal biotechnology.

**TEXT BOOKS:**

1. Sateesh MK (2010) Bioethics and Biosafety, I. K. International Pvt Ltd.

2. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers
3. Patent Strategy For Researches & Research Manegers- Knight, Wiley Publications.
4. Biotechnology & Safety Assessment, Thomas, Ane/Rout Publishers. Bare Act, 2007.Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., New Delhi.
5. Thomas J.A., Fush R.L., (2002), Biotechnology & safety Assessment (3rdEd.), Academicpress.

**REFERENCES:**

1. Intellectual Property Protection & Sustainable Development, Phillipe Cullet, Ldexix Nexis Butterworths.
2. Biotechnology in Comparative Perspective, Fuchs, Ane/Rout Publishers.
3. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005)
4. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).
5. Kankanala C., Genetic Patent law & strategy .First edition .Manupatra ,Information Solution Pvt.Ltd., 2007.

**15 EBM 156 ENTERPRENEURSHIP DEVELOPMENT 3 0 0 3**

**Course Objective:** To identify and train the potential entrepreneurs in the region, to develop necessary knowledge and skills among the participants in EDPSs and to develop and strengthen entrepreneurial quality and motivation.

**UNIT- I**
**INTRODUCTION** **5**

Meaning, Needs and Importance of Entrepreneurship, Promotion of entrepreneurship, Factors influencing entrepreneurship, Features of a successful Entrepreneurship.

**UNIT - II**
**ESTABLISHING AN ENTERPRISE** **10**

Forms of Business Organization, Project Identification, Selection of the product, Project formulation, Assessment of project feasibility.

**UNIT - III**
**FINANCING THE ENTERPRISE** **10**

Importance of finance / loans and repayments, Characteristics of Business finance, Fixed capital management: Sources of fixed capital, working capital its sources and how to move for loans, Inventory direct and indirect raw materials and its management.

**UNIT- IV**
**MARKETING MANAGEMENT** **10**

Meaning and Importance, Marketing-mix, product management – Product line, Product mix, stages of product like cycle, marketing Research and Importance of survey, Physical Distribution and Stock Management.

**UNIT - V**

**ENTREPRENEURSHIP AND INTERNATIONAL BUSINESS 10**

Meaning of International business, Selection of a product, Selection of a market for international business, Export financing, Institutional support for exports.

**TOTAL: 45 h**

**Course Outcome:**

The students will be able to:

CO1: Acquire knowledge to apply entrepreneurship skills
CO2: Formulate plan to analysis product and check feasibility
CO3: Learn about the vital techniques regarding finance and Business
CO4: Acquire practical skills to select a product & the export techniques
CO5: Understand and incorporate the success features for profitable business
CO6: Apply marketing skills in business

**TEXT BOOKS:**

1. Holt DH. Entrepreneurship: New Venture Creation.
2. Kaplan JM Patterns of Entrepreneurship.
3. Gupta CB, Khanka SS. Entrepreneurship and Small Business Management, Sultan Chand & Sons.

**REFERENCE:**

1. Entrepreneurship, Hisrich Peters Sphephard, Tata McGraw Hill
2. Fundamentals of entrepreneurship, S.K. Mohanty, Prentice Hall of India

**15 EBM 157 REGULATORY ASPECTS IN BIOSCIENCES 3 0 0 3**

**Course Objective:** To provide the ability to gain knowledge of different regulatory aspects in biosciences. To make them understand the regulations of Food and Drug Administration and impart the knowledge about Legal issues and Health policies related to Biosciences.

**UNIT- I**

**INDIVIDUAL AND INSTITUTIONAL RESPONSIBILITY & REGULATION BY FDA 9**

Researching a bioethical question, Individual and institutional responsibility, Institutional review boards, Role of independent institutional review boards, The regulation of drugs and biological products by the food and drug administration.

**UNIT- II**

**LEGAL ISSUES AND HEALTH POLICY 9**

Data and safety monitoring, Legal issues, rules to prevent conflict of interest on human subjects, National institutes of health policy on the Inclusion of women and minorities as subjects, Role and importance of trial registries and results databases.

**UNIT- III**

**ETHICAL AND REGULATORY GUIDANCE 9**

Immobilization, The Nurenberg code, Declaration of Helsinki: Ethical principles of medical research involving human subjects, The Belmont report: Ethical principles and guidelines for the protection of human subjects, The common rule, Code of federal regulations.

**UNIT- IV**
**DISTINCTION BETWEEN RESEARCH AND TREATMENT & THE ETHICS OF RANDOMIZED CLINICAL TRIALS 9**

Research and Practice, Demarcating Research and Treatment: A Systematic Approach, The ethics of randomized clinical trials: Problems of the randomized clinical trial, Equipoise and the ethics of clinical research, Randomized controlled trials: Lessons from ECMO.

**UNIT- V ROLE OF PLACEBOS IN CLINICAL RESEARCH & CHANGING LANDSCAPE OF HUMAN EXPERIMENTATION 9**

The continuing unethical use of placebo controls, Placebo-controlled trials and the logic of clinical purpose, Active control trials in the evaluation of new treatments, The changing landscape of human experimentation.

**TOTAL: 45 HOURS**

**Course outcome:**

The students will

CO1: Obtain knowledge about FDA, ethical regulations in an institute
CO2: Gain awareness about the legal issues and the health policies in bioscience
CO3: Gain awareness about different codes, reports involved in medical research
CO4: Understand the difference between research and treatment in clinical trials
CO5: Understand the use of placebo in clinical trials

**TEXTBOOKS:**

1. John I, Gallin, Frederick P, Ognibene "Principles and Practice of Clinical Research", Academic Press, Third Edition, 2012.
2. Ezekiel J, Emanuel, Robert A Crouch, John D Arras, Jonathan D Moreno, Christine Grady, "Ethical and Regulatory Aspects of Clinical Research", Johns Hopkins University Press, First Edition, 2003.

**REFERENCES:**

1. Michael A, Santoro, Thomas M. Gorrie, "Ethicsand the Pharmaceutical Industry", Cambridge University Press, First Edition, 2005.
2. Susan E, Lederer, "Subjected To Science: Human Experimentation in America before the Second World War", Johns Hopkins University Press, First Edition, 1995.

**15 EBM 158PROFESSIONAL ETHICS IN ENGINEERING 3 0 0 3**

**Course Objective:**To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I**

**HUMAN VALUES** **9**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II**

**ENGINEERING ETHICS** **9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Selfinterest – Customs and Religion – Uses of Ethical Theories

**UNIT III**

**ENGINEERING AS SOCIAL EXPERIMENTATION** **9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS** **9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

**UNIT V GLOBAL ISSUES**

**9**

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

**TOTAL: 45 HOURS**

**COURSE OUTCOMES:**

CO1: The students will understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories.
CO2: The students will understand various social issues,code of ethics and role of professional ethics in engineering field .
CO3: The students will be aware of responsibilities of an engineer for safety and risk benefit analysis.
CO4: The students will be aware of professional rights and responsibilities of an engineer.
CO5: The students will acquire knowledge about various roles of engineers in variety of global issues and able to apply ethical principles to resolve situations that arise in their professional lives.

**TEXTBOOKS:**

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

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

**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”, Cengage Learning, 2009
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011

## SYLLABUS
## SKILL ENHANCEMENT ELECTIVE COURSES

| 15NSS255 | NSS – I | L | T | P | C |
|---|---|---|---|---|---|
| | | 1 | 0 | 1 | 2 |

**UNIT I INTRODUCTION AND BASIC CONCEPTS OF NSS 6**

NSS: History, philosophy, aims, objectives –Emblem: flag, motto, song, badge- NSS functionaries: Organizational structure, roles and responsibilities.

**UNIT II NSS PROGRAMS AND ACTIVITIES 6**

Concept of regular activities- special camping-day camps-Basis of adoption of village/slums, Methodology of conducting survey-Financial pattern of the scheme- other youth program/schemes of GOI- Coordination with different agencies- Maintenance of the dairy

**UNIT III UNDERSTANDING YOUTH 6**

Youth: Definition, profile of youth, categories – youth: Issues, challenges and opportunities - Youth as an agent of youth change.

**UNIT IV COMMUNITY MOBILIZATION 6**

Mapping of community stakeholders-Designing the message in the context of the problem and the culture of the community-Identifying methods of mobilization-Youth adult partnership

**UNIT V VOLUNTEERISM AND SHRAMDAN 6**

Indian Tradition of volunteerism-Needs& Importance of volunteerism- Motivation and constraints of volunteerism-Shramdan as a part of volunteerism.

**TOTAL: 30 Hours**

**15GPD251 PERSONALITY DEVELOPMENT I**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**UNIT I SOFT SKILLS I** **6**

Introduction to Personality Development – Meaning-Features of personality=Dimensions of Personality=Determinants of Personality-Features and Traits- Components of self concept-Barriers-Self analysis

**UNIT II SOFT SKILLS II** **6**

Importance of Soft Skills – First impression-Work Place requirements-Discipline-Cleanliness-Hygiene-general Appearance--Building Confidence—Concept of Thinking and Usage-Value of Time-Focus & Commitment.

**UNIT III SOFT SKILLS IN ACTION** **6**

Grooming – Attire – Understanding others- – Stability & Maturity Development – Strength s – Weakness –Opportunities-threats -Merits of SWOT Analysis-Components-how to convert weakness into strengths-Goal settings

**UNIT IV SELF AWARENESS AND SELF ESTEEM** **6**

Definitions-Components of self awareness-Developing Self awareness-Self esteem-meaning-Steps to improve self esteem

**UNIT V SELF MOTIVATION** **6**

Motivation –Meaning-Techniques of self motivation-Motivation & goal setting – Motivation and emotion – Motivation at work.

**Total: 30 Hours**

**REFERENCES:**


1. Personality Development And Soft Skills---Barun K Mitra, Oxford Publication
2. Seven habits of Higly Effective people – Stephen R. covey
3. Emotion, motivation and Self regulation - Nathan C. Hall , McGill University, Canada, Thomas Goetz, University of Konstanz, Germany
4. http://www.emeraldgrouppublishing.com/
5. Psychology of Selfesteem – Nathaniel Branden, Nash (1st edition), Jossey-Bass (32nd anniversary edition


**15GPD252 PERSONALITY DEVELOPMENT II**

| L | T | P | C |
|---|---|---|---|
| 2 | 0 | 0 | 2 |

**UNIT I SOFT SKILLS III** **6**

Basic Etiquette – Email etiquette – Business etiquette – Telephone etiquette – Meeting etiquette – Adjustment of Role & Leadership – Team Management & Development

**UNIT II QUANTITATIVE APTITUDE I 6**

Percentage – Profit Loss -Discount – Ratio Proportion – Time & Work – Time, Speed & Distancel. Problems relating to ages- Permutation &Combination-Probability

**UNIT III QUANTITATIVE APTITUDE II 6**

Mensuration Clocks and Calendars- Boats-Simple Interest –Compound Interest- Fractions and Decimals – Square roots – Functions.

**UNIT IV ANALYTICAL PROBLEMS 6**

Introduction – Linear Sequencing – Seating Arrangements – Distribution/Double Line Up – Selection – Ordering and Sequencing – Binary Logic – Venn Diagrams –Directions.

**UNIT V LOGICAL PROBLEMS 6**

Introduction to Logical problems – Cause and Effect – Course of Action – Statement and Assumption – Letter and Symbol series – Analogies.

**TOTAL: 30 Hours**

**REFERENCES:**


1. Personality Enrichment--K R Dhanalakshmi And N S Raghunathan, Margham Publications
2. Personality Development --Dr V M Selvaraj Bhavani Publications
3. Quantitative Aptitude – R. S Aggarwal
4. Logical and Analytical Reasoning (English) 30th Edition – A.K Gupta


**15GPD253 PERSONALITY DEVELOPMENT III L T P C**
**2 0 0 2**

**UNIT I VERBAL APPTITUDE I 6**

Phonetics/Neutral Accent/Pronunciation – Speech Mechanism/Mouth & Face Exercise – Vowels & Consonants – Sounds – Syllable and Syllable Stress/ Word Stress – Sentence Stress & Intonation – Articulation Exercise – Rate of Speech / Flow of Speech / Idiomatic Phrases.

**UNIT II VERBAL APTITUDE II 6**

Singular/plural-present tense/past tense—genders - Prepositions-conjunctions-Choice of words—simple sentences—compound sentences- summarising phrases—Synonyms—Antonyms—Analogies—Similar Words

**UNIT III SOFT SKILLS IV 6**

Attitude—Meaning- Features of attitude-Formation-Personality Factors-Types of attitude-change in attitude-Developing Positive attitude.

**UNIT IV TIME MANAGEMENT 6**

Definition –Meaning-Importance, Value of time as an important resource- comparison of Time and Money-Circle of influence and circle of control—Definition of URGENT and IMPORTANT—Time Wasters and how to reduce—Procrastination—meaning and impact- 4 Quadrants.

**UNIT V TEAM BUILDING 6**

Meaning—Aspects of team building—Process of team building—Types of Teams-Team ethics and Understanding-Team trust and commitment

**TOTAL: 30 Hours**

**REFERENCES:**


1. Managing Soft Skills And Personality--B N GhoshMcgraw Hill Publications
2. Principles and Practices of Management Shejwalkar and Ghanekar McGraw Hill Latest
3. Time management for Busy people – Roberta roesch, TatamcGraw-Hill Edition
4. Personality Development --Dr V M Selvaraj, Bhavani Publications