SETHU INSTITUTE OF TECHNOLOGY

PULLOOR, KARIAPATTI – 626115

(An Autonomous Institution

Affiliated to Anna University Chennai)

B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

(Applicable to candidates admitted in the Academic Year 2016 - 2017)

SETHU INSTITUTE OF TECHNOLOGY

PULLOOR, KARIAPATTI – 626115

(An Autonomous Institution Affiliated to Anna University Chennai)

B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

(Applicable to candidates admitted in the Academic Year 2016 - 2017)

Chairman
Board of Studies
Chairperson
Board of Studies
Bio Medical Engineering
Sethu Institute of Technology
Kariapatti - 626 115.

Chairman
Academic Council
CHAIRMAN
ACADEMIC COUNCIL
Sethu Institute of Technology
Pulloor, Kariapatti - 625 115

SETHU INSTITUTE OF TECHNOLOGY

PULLOOR, KARIAPATTI – 626115

(An Autonomous Institution affiliated to Anna University, Chennai)

CURRICULUM & SYLLABI

B.E BIOMEDICAL ENGINEERING

REGULATIONS 2015

(Applicable to candidates admitted in the Academic Year 2016 - 2017)

SETHU INSTITUTE OF TECHNOLOGY, PULLOOR, KARIAPATTI – 626115

(An Autonomous Institution affiliated to Anna University, Chennai)

Estd: 1995

SETHU INSTITUTE OF TECHNOLOGY

Pulloor, Kariapatti - 626 115

(An Autonomous Institution)

B.E. Degree Programme

CURRICULUM

Regulation 2015

Bachelor of Engineering in Biomedical Engineering

OVERALL COURSE STRUCTURE

Category	Total No. of Courses	Credits	Percentage
Science & Humanities	05	11	7%
Basic Engineering	09	31	18%
Engineering Sciences	4	09	5%
Professional Core	32	76	45%
Professional Elective	6	18	11%
Open Elective	3	9	5%
Project	2	15	9%
TOTAL	63	169	100

COURSE CREDITS - SEMESTER WISE

Branch	I	II	III	IV	V	VI	VII	VIII	TOTAL
BME	22	21	22	22	22	23	17	20	169

REGULATION 2015

B.E BIOMEDICAL ENGINEERING

CURRICULUM

CHOICE BASED CREDIT SYSTEM

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN101	Technical English (Common to ALL)	2	0	0	2
2.	15UMA102	Engineering Mathematics – I (Common to ALL)	3	2	0	4
3.	15UPH103	Engineering Physics (Common to ALL)	3	0	0	3
4.	15UCY105	Applied Chemistry (Common to CSE, ECE, EEE, IT, BME)	3	0	0	3
5.	15UCS107	Computer Programming (Common to ALL)	3	0	0	3
6.	15UME108	Engineering Graphics (Common to ALL)	2	0	4	4
PRACTICAL						
7.	15UCS109	Computer Programming Laboratory (Common to ALL)	0	0	2	1
8.	15UME110	Engineering Practices Laboratory (Common to MECH,EEE,CIVIL, CHEM & BME)	0	0	2	1
9.	15UGS112	Basic Sciences Laboratory – I (Common to ALL)	0	0	2	1
		Total	16	2	10	22
Total Credits : 22						

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN201	Business English and Presentation Skills (Common to ALL)	3	0	0	3
2.	15UMA202	Engineering Mathematics – II (Common to ALL)	3	2	0	4
3.	15UPH204	Solid State Physics (Common to EEE & BME)	3	0	0	3
4.	15UCY207	Environmental Sciences (Common to ALL)	3	0	0	3
5.	15UBM208	Electrical Circuits Analysis	3	0	0	3
6.	15UBM209	Sensors and Measurement Techniques	3	0	0	3
PRACTICAL						
7.	15UGS210	Basic Sciences Laboratory – II (Common to ALL)	0	0	2	1
8.	15UBM211	Electrical Circuits and Transducer Laboratory	0	0	2	1
		Total	18	2	4	21
Total Credits : 21						

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UMA321	Transforms and Partial Differential Equations (Common to Mech, ECE, EEE, CIVIL,CHEM & BME)	3	2	0	4
2.	15UBM302	Human Anatomy and Physiology	3	0	0	3
3.	15UBM303	Biochemistry	3	0	0	3
4.	15UBM304	Biomedical Instruments	3	0	0	3
5.	15UBM305	Semiconductor Devices and Circuits	3	0	0	3
6.	15UIT327	Object Oriented Programming and Data Structures	3	0	0	3
PRACTICAL						
7.	15UBM307	Semiconductor Devices and Circuits Laboratory	0	0	2	1
8.	15UBM308	Biochemistry Laboratory	0	0	2	1
9.	15UIT328	Object Oriented Programming and Data Structures Laboratory	0	0	2	1
		Total	18	2	6	22
Total Credits : 22						

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UMA424	Probability and Random Processes (Common to ECE & BME)	3	2	0	4
2.	15UBM401	Analog and Digital Integrated Circuits	3	0	0	3
3.	15UBM403	Medical Physics	3	0	0	3
4.	15UBM404	Principles of Signals and Systems	3	0	0	3
5.	15UBM405	Pathology and Microbiology	3	0	0	3
6.	15UBM406	Diagnostic and Therapeutic Equipments – I	3	0	0	3
7.	15UGS431	Reasoning and Quantitative Aptitude (Common to ALL)	1	0	0	1
PRACTICAL						
8.	15UBM407	Analog and Digital Integrated Circuits Laboratory	0	0	2	1
9.	15UBM408	Pathology and Microbiology Laboratory	0	0	2	1
		Total	19	2	4	22
Total Credits : 22						

SEMESTER V

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UBM501	Microprocessor and Controller	3	0	0	3
2.	15UBM502	Diagnostic and Therapeutic Equipments – II	3	0	0	3
3.	15UBM503	Bio Control System	3	2	0	4
4.	15UBM504	Principles of Digital Signal Processing	3	0	0	3
5.		Professional Elective – I	3	0	0	3
6.		Professional Elective – II	3	0	0	3
PRACTICAL						
7.	15UBM507	Microprocessor and Controller Laboratory	0	0	2	1
8.	15UBM508	Signal Processing Techniques Laboratory	0	0	2	1
9.	15UBM509	Diagnostic and Therapeutic Equipments Laboratory	0	0	2	1
		Total	18	2	6	22
Total Credits : 22						

SEMESTER VI

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UBM601	Medical Imaging Equipments	3	0	0	3
2.	15UBM602	Image Processing Techniques	3	0	0	3
3.	15UBM603	Biomechanics	3	0	0	3
4.		Professional Elective – III	3	0	0	3
5.		Professional Elective – IV	3	0	0	3
6.		Open Elective – I	3	0	0	3
PRACTICAL						
7.	15UBM607	Image Processing Techniques Laboratory	0	0	2	1
8.	15UBM608	Technical Project	0	0	6	3
9.	15UGS531	Soft skills and communication Laboratory (Common to MECH, CIVIL, CHEM & BME)	0	0	2	1
		Total	18	0	10	23
Total Credits : 23						

SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UBM701	Hospital Management	3	0	0	3
2.	15UBM702	Human Assist Devices	3	0	0	3
3.	15UBM703	Neural Networks and Pattern Recognition	3	0	0	3
4.		Professional Elective – V	3	0	0	3
5.		Open Elective – II	3	0	0	3
PRACTICAL						
6.	15UBM706	Hospital Training	0	0	2	1
7.	15UBM707	Project Design Laboratory	0	0	2	1
		Total	15	0	4	17
Total Credits : 17						

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UME801	Professional Ethics (Common to ALL)	2	0	0	2
2.		Professional Elective – VI	3	0	0	3
3.		Open Elective – III	3	0	0	3
PRACTICAL						
4.	15UBM804	Project work	0	0	24	12
		Total	8	0	24	20
Total Credits : 20						

LIST OF ELECTIVES

Course Code	Course Title	L	T	P	C
15UBM901	BioMEMS and Nano Electronics	3	0	0	3
15UBM902	Clinical Engineering	3	0	0	3
15UBM903	Intellectual Property Rights	3	0	0	3
15UBM904	Forensic Science	3	0	0	3
15UBM905	Drug Delivery Systems	3	0	0	3
15UBM906	Nuclear Medicine	3	0	0	3
15UBM907	Medical Radiation Safety Engineering	3	0	0	3
15UBM908	Biomaterials	3	0	0	3
15UBM909	Medical Optics	3	0	0	3
15UBM910	Bio Statistics	3	0	0	3
15UBM911	Communication Engineering	2	0	2	3
15UBM912	Biometric Systems	3	0	0	3
15UBM913	Medical Informatics	3	0	0	3
15UBM914	Telemedicine	3	0	0	3
15UBM915	Rehabilitation Engineering	3	0	0	3
15UBM916	Virtual Instrumentation for Biomedical Engineers	2	0	2	3
15UBM917	Embedded Systems in Medicine	3	0	0	3
15UBM918	Brain Computer Interface	3	0	0	3
15UBM919	Neuroscience	3	0	0	3
15UBM920	Cancer Biology	3	0	0	3
15UBM921	Robotics and Automation in medicine	3	0	0	3
15UBM922	Bio-Dynamics	3	0	0	3
15UBM923	Orthopedic mechanics	3	0	0	3
15UBM924	Physiological Modeling	2	0	2	3

LIST OF OPEN ELECTIVES

S. No	Course Code	Course Title	L	T	P	C
1	15UBM951	Biomedical Instrumentation Systems	3	0	0	3
2	15UBM952	Computer Applications in Medicine	3	0	0	3
3	15UBM953	Forensic Science in Health Care	3	0	0	3
4	15UBM954	Nuclear Medicine	3	0	0	3

LIST OF ONE CREDIT COURSES

S. No	Course Code	Course Title	L	T	P	C
1	15UBM861	Introduction to MATLAB	0	0	2	1
2	15UBM862	LabView for Medical Applications	0	0	2	1
3	15UBM863	Virtual Learning of Anatomy and Physiology	0	0	2	1
4	15UBM864	DICOM Introduction and Interpretation	0	0	2	1
5	15UBM865	Medical Coding	0	0	2	1
6	15UBM866	Multi Medical Equipments Operating Skills Laboratory	0	0	2	1
7	15UBM867	Medical Science	0	0	2	1
8	15UBM868	3D Printing applicable to Medical Field	0	0	2	1

LIST OF INTER DISICIPLINARY COURSES

S. No	Course Code	Course Title	L	T	P	C
1	15UGM951	Electrical Hazards and Safety In Hospitals	3	0	0	3
2	15UGM952	Biofluid Mechanics	3	0	0	3
3	15UGM953	Big Data and IOT in Medical Applications	3	0	0	3

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN101	Technical English (Common to ALL)	2	0	0	2
2.	15UMA102	Engineering Mathematics – I (Common to ALL)	3	2	0	4
3.	15UPH103	Engineering Physics (Common to ALL)	3	0	0	3
4.	15UCY105	Applied Chemistry (Common to CSE, ECE, EEE, IT, BME)	3	0	0	3
5.	15UCS107	Computer Programming (Common to ALL)	3	0	0	3
6.	15UME108	Engineering Graphics (Common to ALL)	2	0	4	4
PRACTICAL						
7.	15UCS109	Computer Programming Laboratory (Common to ALL)	0	0	2	1
8.	15UME110	Engineering Practices Laboratory (Common to MECH,EEE,CIVIL, CHEM & BME)	0	0	2	1
9.	15UGS112	Basic Sciences Laboratory – I (Common to ALL)	0	0	2	1
		Total	16	2	10	22
Total Credits : 22						

15UEN101	TECHNICAL ENGLISH – I (Common to All Branches)	L 2	T 0	P 0	C 2

OBJECTIVES:

- To improve the language proficiency of students
- To enhance the vocabulary of students
- To strengthen the language competency through grammar

UNIT I

Grammar - Parts of Speech -Tense – Vocabulary – Technical Word Formation- Prefix & suffix - Synonyms and Antonyms – Writing – Instructions – Formal Letters - Reading - Comprehension - Prose: A Nation's Strength – Dr. Karan Singh

UNIT II

Grammar – Concord -'Wh' Questions – Vocabulary – One Word Substitutes – Listening & Speaking – Conducting Meetings – Writing - Preparation of the Checklist – Reading - Prose: My Vision for India - Dr.A.P.J.Abdul Kalam

UNIT III

Grammar – Voice – Vocabulary – Compound Nouns Writing – Minutes – Agenda - Transformation of Information (Transcoding) - Reading - Prose: Professions of Women - Virginia Woolf

UNIT IV

Grammar - Conditional clauses - Vocabulary - Idioms & Phrases – Writing - Letters to Editor - Making Invitations - Acceptance & Declining - Summarizing – Reading - Prose: Computers - Peter Laurie

UNIT V

Grammar – Determiners – Vocabulary – Homophones & Homonyms – Writing – Recommendations - Note Making - Report Writing - Reading – Prose: What We Must Learn From the West - Narayana Murthy

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Use grammar effectively in writing meaningful sentences and paragraphs
- Exhibit improved reading comprehension and vocabulary.
- Demonstrate writing skills in various formal situations.
- Demonstrate improved oral fluency Presenting reports on various purposes
- Presenting reports on various purposes

REFERENCE BOOKS:

1. Meenakshi Raman, Sangeetha Sharma, "Technical Communication English for Engineers", Chennai, Oxford University Press, (2008).
2. Asraf Rizvi.M, "Effective Technical Communication", New Delhi, Tata McGraw-Hill Publishing Company Limited, (2007).
3. Lakshminarayanan.K.R, "English for Technical Communication", Chennai, Scitech Publications (India) Pvt.Ltd, (2004).

15UMA102	ENGINEERING MATHEMATICS – I (Common to ALL Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To make the students capable of identifying algebraic eigen value problems from practical areas and obtain the eigen solutions in certain cases.
- To make the students knowledgeable in integrating various types of functions using various integration methods.
- To familiarize the students with the basic rules of differentiation and use them to find derivatives of products and quotients that they might encounter in their studies of other subjects in the same or higher semesters.

UNIT I DIFFERENTIAL CALCULUS 9 + 6

Introduction – Definition of derivatives – Limits and Continuity – Differentiation techniques (Product rule, Quotient rule, Chain rule) – Successive differentiation (n^{th} derivatives) – Leibnitz theorem (without proof) – Maclaurin's series – Physical Applications (Newton's law of cooling – Heat flow problems, Rate of decay of radioactive materials - Chemical reactions and solutions, Ohm's law, Kirchoff's law – Simple electric circuit problems)

UNIT II FUNCTIONS OF SEVERAL VARIABLES 9 + 6

Partial derivatives – Euler's theorem for homogenous functions – Total derivatives –Differentiation of implicit functions – Jacobian – Taylor's expansion – Maxima and Minima – Method of Lagrangian Multipliers.

UNIT III INTEGRAL CALCULUS 8 + 6

Definitions and concepts of integrals – Methods of integration (Decomposition method, Substitution method, Integration by parts) – Definite integrals – Properties and problems – Reduction formulae – Beta and Gamma functions .

UNIT IV MULTIPLE INTEGRALS 8+ 6

Double integration – Cartesian and Polar coordinates – Change of order of integration – Area as a double integral - Change of variables between Cartesian and Polar coordinates – Triple integration in Cartesian coordinates – Volume as triple integral.

UNIT V MATRICES 8 + 6

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

SUPPLEMENT TOPIC(for internal evaluation only-)3

Evocation /Application of Mathematics, Quick Mathematics – Speed Multiplication and DivisionApplications of Matrices.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

1. Analyze functions using limits, continuity and derivatives to solve problems involving these functions.
2. Use the Lagrange multiplier method to predict extreme values of functions with constraints and to find the absolute maximum and minimum of a function on different domains.
3. Apply the various methods of integration for evaluating definite integrals.
4. Apply the knowledge of multiple integrals to findthe area and volume of region bounded by the given curves.
5. Find Eigen values and Eigenvectors for symmetric and non-symmetric matrices

TEXT BOOKS:

1. BALI N. P and MANISH GOYAL, "A Text book of Engineering Mathematics", Laxmi Publications (P) Ltd, New Delhi, 8th Edition, (2011).
2. GREWAL. B.S, "Higher Engineering Mathematics", Khanna Publications, New Delhi, 42ndEdition, (2012).

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. GLYN JAMES, "Advanced Engineering Mathematics",Pearson Education, New Delhi, 7th Edition, (2007).
3. JAIN R.K and IYENGAR S.R.K," Advanced Engineering Mathematics", Narosa Publishing House, New Delhi, 3rd Edition, (2007).
4. BHARATI KRISHNA TIRTHAJI, "Vedic Mathematics - Mental Calculation",MotilalBanarsidass Publications, New Delhi, 1st Edition, (1965).
5. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
6. P.SIVARAMAKRISHNA DAS,E.RUKMANGADACHARI"Engineering mathematics",volume1, Pearson Edison New Delhi, 2nd Edition, (2013).

15UPH103	ENGINEERING PHYSICS (Common to All Branches)	L 3	T 2	P 0	C 4

OBJECTIVES:

- To develop the research interest in crystal physics.
- To make students to understand classification of sound and applications of Ultrasonics.
- To use the principles of Lasers and its types.
- To apply principles of Quantum physics in engineering field.
- To develop knowledge on principles of Thermal Physics.

UNIT I CRYSTAL PHYSICS 9

Crystalline – Amorphous materials – single and poly crystal- Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – parameters of Unit cell – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – crystal growth technique- Bridgeman method.

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound – decibel- weber- Fechner law – Units of Loudness- decibel- phon- sone- Reverberation – Absorption Coefficient –Introduction to ultrasonics- magnetostriction effect – piezoelectric effect - piezoelectric generator- Detection of ultrasonic waves - properties – Cavitations -Velocity measurement – acoustic grating - Industrial applications – SONAR)

UNIT III WAVE OPTICS AND LASERS 9

Introduction – interference – refractive index –Expression for plane, circularly and elliptically polarized light LASER: Introduction- Principles of Laser- Einstein theory of stimulated emission- Population inversion Methods - Types of lasers – Co2 laser - semiconductor laser – homojunction – heterojunction - Applications

UNIT IV QUANTUM PHYSICS 9

Introduction to black body- de Broglie wavelength – Schrödinger's wave equation – Time dependent – Time independent equation – Physical significance of wave function - Compton Effect – Theory and experimental verification.

UNIT V PROPERTIES OF SOLIDS AND THERMAL PHYSICS 9

Elasticity- Hooke's law –Different types of moduli of elasticity– stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever – Young's modulus by uniform bending - Thermal conductivity- Newton's law of cooling – Lee's disc method - Concept of Entropy.

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply the crystal growth techniques
- Discuss the basic concepts of Acoustics and Ultrasonics.

- Acquire knowledge about wave optics and Lasers
- Summarize the principles of quantum physics
- Explain the methods of thermal conduction

TEXT BOOKS:

1. Dr. Mani.P, “A Text Book of Engineering Physics”, Dhanam Publications, Chennai, Edition (2014).
2. Rajendran.V, “Engineering,Physics”, Tata Mc-Graw Hill Publishing Company limited, New Delhi, Revised Edition, (2013).
3. Palanisami P.K., “Physics For Engineers”, Scitech Publications (India), Pvt Ltd., Chennai, (2014).

REFERENCE BOOKS:

1. Raghuvenshi G.S., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition, (2014)
2. Arul doss .G., “Engineering Physics”, PHI Learning Limited, New Delhi, Revised Edition, (2013)
3. Marikani.A., “Engineering Physics”, PHI Learning Private Limited, New Delhi, Revised Edition (2012).
4. Sankar B.N., and Pillai .S.O., “A Text Book of Engineering Physics”, New Age International Publishers Private Limited, New Delhi, Revised Edition, (2013).
5. Avadhanulu M.N. and Kshirsagar P.G., “A Textbook: of Engineering Physics”, S.Chand & Company Ltd., New Delhi, (2015).

15UCY105	APPLIED CHEMISTRY (Common to CSE, ECE, EEE, IT & EIE branches)	L	T	P	C
		3	2	0	4

OBJECTIVES:

- Introduction to the fundamental concepts of chemical bonds.
- Understand the principles and applications of corrosion science.
- Gain knowledge about energy storage devices & electrochemical sensors.
- Understand the principles and applications of spectroscopy and the concept of green chemistry.
- Acquire knowledge on smart materials.

UNIT I CHEMICAL BONDING 9

Chemical Bonding: Electronic Configuration– Ionic Bond - Covalent Bond – Metallic bond –Aufbau principle, Octet Rule, Pauli Exclusion principle, Molecular Orbital theory, Valence bond theory and its limitations, Various types of hybridization (Homo nuclear & Hetero nuclear diatomic molecules) and shapes of molecules based on MO theory -bond strength and bond energy, Born-Haber cycle, Fajan's rule–Non Covalent Bonding-Hydrogen bonding, Vander Waals forces..

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Introduction -Electrochemical cells- reversible and irreversible cells – EMF – measurement of EMF -Single electrode potential-Nernst equation.Chemical corrosion: Introduction- Definition- Types - (Dry corrosion, mechanism and its Example)-Electrochemical corrosion (Wet corrosion, mechanism and its Types – Galvanic & Differential aeration Corrosion-Pitting, crevice & Wire fence corrosion). Factors influencing rate of corrosion. Corrosion prevention - Cathodic protection, Corrosion inhibitors, and Protective coatings – Paint, Electro plating – Gold plating-Risk Analysis, Alloy Plating, Electroless plating – Nickel plating.

UNIT III CONVENTIONAL ENERGY STORAGE DEVICES AND SENSORS 9

Conventional devices - Batteries- Primary and secondary batteries- Construction, working and applications of Zn – MnO_2, Lead acid storage and Cd batteries. Fuel cells – Differences between battery and fuel cell, construction and working of H_2– O_2 fuel cell.

Electrochemical sensors: Chemically modified electrode (CMEs) – Concept, CMEs sensors, Chemical sensors – gas sensors – ion selective electrodes, principle, types (solid state membranes and liquid membranes) and applications. Biosensors – electrochemical biosensors – glucose biosensors.

UNIT IV INSTRUMENTATION FOR ANALYTICAL METHODS AND GREEN CHEMISTRY 9

Beer-Lamberts law - Principle, instrumentation and applications - UV spectrophotometer-X-ray diffractometer - Thermo Gravimetric Analysis (TGA) - Differential Thermal Analysis (DTA)-Differential Scanning Colorimetry (DSC).

Green chemistry – Concept, importance, principles – e- waste disposal

UNIT V POLYMERS AND SMART MATERIALS 9

Introduction- Terminology- structure and properties - Conducting polymers – Chemical and Electrochemical doping; Charge transfer polymer – Polymers filled with conductive solids, Organic Light emitting diodes – Principles and applications, Liquid crystals – definition and applications..

COURSE OUTCOMES:

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

- Have sound knowledge on the basics of chemistry related to bonding.
- Know the principles, various types of corrosion and corrosion control techniques.
- Realize the need of green practices in energy storage devices.

- Identify the instruments for chemical analysis.
- Gain knowledge on polymers in electronics and its applications.

TEXT BOOKS

1. Jain P.C. and Monica Jain, “Engineering Chemistry”, DhanpatRai Publishing Company (P)Ltd., New Delhi, (2010).
2. Dr.Sunita Rattan, “A Textbook of Engineering Chemistry” S.K.Kataria& Sons., New Delhi, (2013).

REFERENCE BOOKS:

1. Derek Pletcher and Frank C. Walsh, “Industrial Electrochemistry”, Chapman and Hall, New York, (1993).
2. Peter Grundler, “Chemical Sensors – An introduction for Scientists and Engineers”, Springer, New York, (2007).
3. Arnost Reiser, “Photoreactive Polymers the Science and Technology of Resists”, Wiley Interscience, New York, (1989).
4. Paul T. Anastas, John C. Warner, ‘Green Chemistry: Theory and Practice’, Oxford University Press, (2000).

15UCS107	COMPUTER PROGRAMMING (Common to All Branches)	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To impart the concepts in basic organization of computers and problem solving techniques.
- To familiarize the programming constructs of C.
- To explain the concepts of arrays, strings, functions, pointers, structures and unions in C

UNIT I INTRODUCTION

Generation and Classification of Computers - Basic Organization of a Computer – Problem formulation – Problem Solving - Need for logical analysis and thinking – Algorithm – Pseudo code – Flow Chart.

UNIT II C PROGRAMMING BASICS

Introduction to ' C' programming – fundamentals – structure of a 'C' program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in 'C' – Managing Input and Output operations

UNIT III DECISION MAKING AND LOOPING STATEMENTS

if - if-else - nested if-else – else-if ladder statement – switch – goto – for- while – do-while – break – continue statements – Problem solving with decision making and looping statements

UNIT IV ARRAYS, STRINGS AND FUNCTIONS

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays - String - String operations – string arrays - Function – definition of function – Declaration of function – Parameter passing methods – Recursion - Storage classes – Problem solving with arrays, strings and functions

UNIT V POINTERS, STRUCTURES AND UNIONS

Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic Memory allocation – Structure - need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Pre-processor directives

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Illustrate the basics about computer
- Develop simple programs using branching and looping constructs
- write C program to manage data using arrays
- Develop programs using functions
- Write C programs for simple applications

TEXT BOOKS

1. Sutha . J, "Computer Programming", Littlemoon Publications, Kariapatti, Third Edition, (2015).
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", Oxford University Press, First Edition, (2009).
3. Behrouz A. Forouzan, Richard F.Gilberg, "A Structured Programming Approach using C", Third Edition, Thomson Course Technology, (2007).

REFERENCE BOOKS:

1. Yashavant P. Kanetkar. " Let Us C", BPB Publications, (2011).
2. Kernighan.B.W, Ritchie.D.M, "The C Programming language", Pearson Education, Second Edition, (2006).
3. Stephen G.Kochan, "Programming in C", Pearson Education India, Third Edition, (2005).
4. Anita Goel ,Ajay Mittal, " Computer Fundamentals and Programming in C"", Dorling Kindersley (India) Pvt. Ltd, Pearson Education in South Asia, (2011).
5. Byron S Gottfried," Programming with C ", Schaum's Outlines, Tata McGraw-Hill, Second Edition, (2006).

15UME108	ENGINEERING GRAPHICS (Common to All Branches)	L	T	P	C
		3	2	4	4

OBJECTIVES:

- To develop in students graphic skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings
- To impart knowledge in development of surfaces, isometric and perspective projections

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

Importance of Graphics in Engineering Applications – Use of Drafting Instruments – BIS Conventions and Specifications – Size, Layout and Folding of Drawing Sheets – Lettering and Dimensioning

UNIT I PLANE CURVES, PROJECTION OF POINTS, LINES AND PLANE SURFACES 9+6

Plane Curves: (Not for Examination)
Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of squad and circle – Drawing of tangents and normal to the above curves.
Projections:
Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II PROJECTION OF SOLIDS 9+6

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to horizontal plane (HP) only.

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9+6

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other – Obtaining true shape of section.
Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones

UNIT IV ISOMETRIC AND PERSPECTIVE PROJECTIONS 9+6

Isometric Projections Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones.
Perspective Projections (Not for Examination)
Perspective projection of prisms, pyramids and cylinders by visual

UNIT V ORTHOGRAPHIC PROJECTION 9+6

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills of multiple views from pictorial views of objects.

Total : 45 (L) + 15 (T) = 60 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Discuss first angle projection to project straight line, planes and solids.
- Illustrate simple solids like prisms, pyramids, cylinder and cone.
- Construct section of solids and development of surfaces for engineering applications.
- Prepare isometric views of objects like truncated solids and frustums.
- Prepare orthographic views from isometric drawings.

TEXT BOOKS:

1. Natarajan K.V., “A Text book of Engineering Graphics”, Dhanalakshmi Publishers, (2006).
2. Bhatt N.D., “Engineering Drawing”, 46th Edition, Charotar Publishing House, (2003).

REFERENCE BOOKS:

1. Venugopal K., and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, (2008).
2. Gopalakrishnan K.R., “Engineering Drawing” (Vol .I&II), Subhas Publications,(1998).
3. Dhananjay A.Jolhe, “Engineering Drawing with an introduction to Auto CAD”, Tata Mc Graw Hill Publishing Company Limited, (2008).

15UCS109	COMPUTER PROGRAMMING LABORATORY – I	L	T	P	C
	(Common to All Branches)	0	0	2	1

OBJECTIVES :

- To make the students to work with Office software.
- To familiarize the implementation of programs in C.

LIST OF EXPERIMENTS

a) Word Processing
Document creation, Formatting, Table Creation, Mail merge

b) Spread Sheet
Chart - Line, XY, Bar and Pie, Formula - formula editor.

c) C Programming
- Programs using simple statements
- Programs using decision making statements
- Programs using looping statements
- Programs using one dimensional and two dimensional arrays
- Solving problems using string functions
- Programs using user defined functions and recursive functions
- Programs using pointers
- Programs using structures and unions

Total :30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Create the document in Word Processing software.
- Write programs using control constructs.
- Apply functions to reduce redundancy.
- Design and implement C programs for simple applications.

HARDWARE / SOFTWARE REQUIRED FOR A BATCH OF 30 STUDENTS

HARDWARE

LAN SYSTEM WITH 30 NODES (OR) STANDALONE PCS – 30 NOS.

SOFTWARE

OS – UNIX CLONE (License free Linux)
APPLICATION PACKAGE – OFFICE SUITE
COMPILER – C

15UME110	ENGINEERING PRACTICES LABORATORY	L	T	P	C
	(Common to MECH,EEE,CIVIL, CHEM, BME & AE)	0	0	2	1

OBJECTIVES:

- To demonstrate the plumbing and carpentry works.
- To train the students to perform welding and drilling operations.
- To demonstrate residential house wiring, fluorescent lamp wiring, measurement of earth resistance, colour coding of resistors, logic gates and soldering.

LIST OF EXPERIMENTS

GROUP A

(CIVIL & MECHANICAL)

I) CIVIL ENGINEERING PRACTICE **6**

Buildings:

a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing works:

b) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
c) Study of pipe connections requirements for pumps and turbines.
d) Preparation of plumbing line sketches for water supply and sewage works.
e) Hands-on-exercise: Basic pipe connections–Mixed pipe material connection Pipe connections with different joining components.
f) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using power tools on:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.

II) MECHANICAL ENGINEERING PRACTICE **9**

Welding:

(a) Preparation of arc welding of butt joints, lap joints and tee joints.
(b) Study of Gas welding practice.

Basic Machining:

(a) Drilling Practice

Sheet Metal Work:

(a) Model making – Trays, funnels, etc.
(b) Study of Different type of joints.

Machine assembly practice:

(a) Study of centrifugal pump
(b) Study of air Conditioner

Demonstration on:

(a) Smithy operations, upsetting, swaging, setting down and bending.
(b) Foundry operations like mould preparation for gear and step cone pulley.

GROUP B

(ELECTRICAL & ELECTRONICS)

III) ELECTRICAL ENGINEERING PRACTICE 7

(a) Residential house wiring using switches, fuse, indicator, lamp and energy meter and Stair case wiring
(b) Fluorescent lamp wiring.
(c) Measurement of resistance to earth of electrical equipment.

IV) ELECTRONICS ENGINEERING PRACTICE 8

(a) Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms, period, frequency) using CRO.
(b) Study of logic gates AND, OR, EX-OR and NOT Gate.
(c) Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

Total :30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Perform basic plumbing and carpentry works.
- Demonstrate the welding and drilling.
- Build sheet metal models like tray and funnel.
- Demonstrate the basic residential house wiring.
- Acquire knowledge in soldering practice and logic gates.

GROUP B

(ELECTRICAL & ELECTRONICS)

III) ELECTRICAL ENGINEERING PRACTICE 10

(a) Residential house wiring using switches, fuse, indicator, lamp and energy meter and Stair case wiring
(b) Fluorescent lamp wiring.
(c) Measurement of resistance to earth of electrical equipment.

IV) ELECTRONICS ENGINEERING PRACTICE 13

(a) Study of Electronic components and equipments – Resistor, colour coding measurement of AC Signal parameter (peak-peak, rms, period, frequency) using CRO.
(b) Study of logic gates AND, OR, EX-OR and NOT Gates.
(c) Soldering practice – Components, Devices and Circuits – Using general purpose PCB.

TOTAL: 45 PERIODS

EQUIPMENT REQUIREMENT

CIVIL ENGINEERING

Sl. No.	Name of the equipment/software	Quantity Required
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings	5 Sets
2	Carpentry vice (fitted to work bench)	15 Nos.
3	Standard woodworking tools	15 Sets.
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tool Rotary Hammer	2 Nos
6	Demolition Hammer	2 Nos
7	Circular Saw	2 Nos
8	Planer	2 Nos
9	Hand Drilling Machine	2 Nos
10	Jigsaw	2 Nos

MECHANICAL ENGINEERING

Sl. No.	Name of the equipment/software	Quantity Required
1	Arc welding transformer with cables and holders	5 Nos.
2	Welding booth with exhaust facility	5 Nos.
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 Sets.
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit	2 Nos.
5	Smithy tools	2 Sets.
6	Moulding table, foundry tools	2 Sets.
7	Study-purpose items: centrifugal pump, air-conditioner	One each.

ELECTRICAL ENGINEERING

Sl.No	Name of the equipment/software	Quantity Required
1	Assorted electrical components for house wiring	15 sets
2	Electrical measuring instruments	10
3	Megger (250V/500V)	1 No.
4	Study purpose items: Iron box, fan and regulator, emergency lamp	One each
5	Power Tools: (a) Range Finder (b) Digital Live-wire detector	2 No.

ELECTRONICS ENGINEERING

Sl. No.	Name of the equipment/software	Quantity Required
1	Logic trainer kit	2
2	CRO,AFO	2 each
3	Small multipurpose PCBs	10 No.
4	Soldering guns	10
5	Multimeters	2
6	Assorted electronic components for making circuits	Required quantity

15UGS112	BASIC SCIENCES LABORATORY 1	L	T	P	C
	(Common to All Branches)	**0**	**0**	**2**	**1**

OBJECTIVES:

- To create scientific Temper among the students.
- To know how to execute experiments properly, presentation of observations and arrival of conclusions.
- To view and realize the theoretical knowledge acquired by the students through experiments

PHYSICS LABORATORY

LIST OF EXPERIMENTS

(Common to All Branches)

1. Laser – Determination of particle size and wavelength of Laser source using Diode Laser.
2. Ultrasonic Interferometer - Determination of velocity of sound and compressibility of liquid.
3. Poiseuille's method - Determination of viscosity of liquid.
4. Spectrometer – Determination of dispersive power of a prism.
5. Compound pendulum – Determination of the acceleration due to gravity
6. Air Wedge method - Determination of thickness of a thin wire.

A minimum of FIVE experiments shall be offered

Total :30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Familiarize the fundamentals of various science and technology subjects and thus acquire the capability to applying them.
- Acquire laboratory skills in handling various equipments and in turn make them knowledgeable in future research aspirations.

Laboratory classes on alternate weeks for Physics and Chemistry

CHEMISTRY LABORATORY

OBJECTIVES:

- To impart knowledge on basic concepts in application of chemical analysis
- To train the students in instrumental methods
- To develop skills in estimation of various ions by chemical and instrumentation methods

LIST OF EXPERIMENTS

(*common to* CSE, ECE, EEE, IT& BME *branches)*

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Conductometric Titration of strong acid with strong base
3. Estimation of Fe^{2+} ion by potentiometry
4. Determination of Strength of given acid using pH metry

5. Determination of molecular weight of polymer by viscometry
6. Comparison of the electrical conductivity of two samples-conductometric method
7. Estimation of copper in brass by EDTA method

LIST OF EXPERIMENTS

(*common to* MECH & CHEMICAL *branches)*

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Estimation of copper in brass by EDTA method .
3. Conductometric Titration of strong acid with strong base
4. Estimation of Fe^{2+} ion by potentiometry
5. Determination of Strength of given acid using pH metry
6. Determination of corrosion rate by weight loss method.
7. Comparison of the electrical conductivity of two samples-conductometric method.

LIST OF EXPERIMENTS

(*For* CIVIL & AGRICULTURAL *branches only)*

1. Preparation of molar and normal solutions of the following substances – Oxalic acid , Sodium Carbonate , Sodium Hydroxide and Hydrochloric acid.
2. Conductometric Titration of Mixture of Acids
3. Estimation of Fe^{2+} ion by potentiometry.
4. Determination of Strength of given acid using pH metry
5. Determination of suspended and dissolved solids in water.
6. Comparison of the electrical conductivity of two samples-conductometric method
7. Estimation of copper in brass by EDTA method

A minimum of FIVE experiments shall be offered for every course

Total :30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Estimate the ions present in the given sample
- Determine the rate of corrosion, molecular weight and amount of solids in water.
- Estimate the acidity of water sample

LIST OF EQUIPMENTS REQUIRMENT

S.No.	Name of the Equipment / Software	Quantity Required
1	Electronic Balance	1No.
2	pH Meter	8 Nos.
3	Conductivity bridge	8 Nos.

4	Potentiometer	8 Nos.
5	Conductivity cell	8 Nos.
6	Calomel electrodes	8 Nos.
7	Oswald viscometer	15 Nos.
8	Glassware	Sufficient Quantity

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UEN201	Business English and Presentation Skills (Common to ALL)	3	0	0	3
2.	15UMA202	Engineering Mathematics – II (Common to ALL)	3	2	0	4
3.	15UPH204	Solid State Physics (Common to EEE & BME)	3	0	0	3
4.	15UCY207	Environmental Sciences (Common to ALL)	3	0	0	3
5.	15UBM208	Electrical Circuits Analysis	3	0	0	3
6.	15UBM209	Sensors and Measurement Techniques	3	0	0	3
PRACTICAL						
7.	15UGS210	Basic Sciences Laboratory – II (Common to ALL)	0	0	2	1
8.	15UBM211	Electrical Circuits and Transducer Laboratory	0	0	2	1
		Total	18	4	4	21
Total Credits : 21						

15UEN201 BUSINESS ENGLISH & PRESENTATION SKILLS **L T P C**
(Common to All Branches) **3 0 0 3**

OBJECTIVES:

- To use linguistic tools confidently in an English speaking context
- To listen and speak during normal business activities such as interviews, meetings, telephone conversations and negotiations.
- To write business letters, emails, reports, articles and comprehend information on the Internet and other media.
- To gain language skills for real business life situations

Unit – I **9**

Grammar- Numerical Adjective; **Vocabulary** - Job title and describing jobs; **Listening** - Listening to company culture; **Reading** - Quiz; **Writing** - Writing formal and semi formal business letters; **Speaking** – Personal information, Companies and products.

Unit – II **9**

Grammar –Modals; **Vocabulary –** Collocations; **Listening** - Business Proceedings; **Reading** - Designing websites and e– mail ; **Writing** – Memo; **Speaking -** Role play on various business situation.

Unit – III **9**

Grammar – prepositions-Articles; **Vocabulary –**Jargons related to Shares and stock;
Listening – Interviews of celebrities; **Reading –** Shares and stock exchange transactions; **Writing** – Business report- Minutes of meeting; **Speaking** – Presentations, Making a business talk.

Unit – IV **9**

Grammar - Connectives; Vocabulary –Words related to finance; Listening - Listening to statistical information; **Reading** - Interpreting business related bar charts; **Writing** - Letters to express interest in new products; **Speaking** - Presenting a summary of an article.

Unit - V **9**

Grammar - Reported speech; **Vocabulary** – Words related to employment ; **Listening**- Listening to audio and video speech of business people; **Reading** - Reading News paper article/magazine articles on business; **Writing** - Writing a Proposal; **Speaking** - Discussing company policies.

TOTAL: *45* (L) = 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of this course, the student will be able to:

- Use business vocabulary effectively to present the ideas.
- Analyze verbal and written communications & evaluate their usefulness
- Write effectively in a wide range of business situations
- Explain more confidently in business meetings and over telephone
- Make a presentation in English in different Business Situations

TEXT BOOK:
To be compiled by the Department

REFERENCE BOOKS:

1. Michael McCarthy, Felicity O'Dell, English Collocations in Use,Noida, Cambridge University Press,2006
2. Allan Pease, Body Language, New Delhi,Sudha Publications(P) Ltd,2005
3. Malcolm Goodale, Professional Presentations,New Delhi,Cambridge University Press,2006
4. Amin.A,Eravelly.R,Ibrahim.F.J,Grammar Builder,Cambridge University Press and Pan Asia Publications Sdn Bhd 2004
5. Randolph Hudson.H,Bernard Selzler.J,Business Communication,Jaico Publishing House,2006

Question Paper Pattern

Sl. No.	Type of questions	Marks
	Part-A	
I (a).	Multiple Choice Questions (Ap)	10 X 1 = 10 Marks
(b).	Factual Questions (U)	5 X 2 = 10 Marks
	Part-B	
II (a).	Interpreting Business Related Bar Charts (E)	10 Marks
(b).	Letter Writing (Ap)	10 Marks
(c).	Writing a Proposal (Ap)	10 Marks
(d).	Writing Memo (Ap)	10 Marks
(e).	Enquiry of a new product (E)	10Marks
(f).	Reading Comprehension (Ap)	10 Marks
	Part-C	
III (a).	Business Report (E)	10 Marks
(b).	Summary of given Article (C)	10 Marks

ENGINEERING MATHEMATICS – II

15UMA202	L	T	P	C
(Common to ALL Branches)				
	3	2	0	4

OBJECTIVES :

- To develop an understanding of the basics of vector calculus comprising of gradient, divergence and curl, and line, surface and volume integrals and the classical theorems involving them.
- To acquaint the student with the concepts of analytic functions and their interesting properties which could be exploited in a few engineering areas, and be introduced to the host of conformal mappings with a few standard examples that have direct application.
- To make the student acquire sound knowledge of Laplace transform and its properties and sufficient exposure to the solution of certain linear differential equations using the Laplace transform technique.

UNIT I ANALYTICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 8 + 6

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Applications of ODE (Bacterial growth, Population growth, Decayed problems).

UNIT II VECTOR CALCULUS 8 + 6

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

UNIT III ANALYTIC FUNCTIONS 8 + 6

Functions of a complex variable – Analytic function – Necessary and Sufficient Conditions (excluding Proofs) – Harmonic function - Properties of an analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w = z+c, cz, 1/z, and Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 9 + 6

Statement and applications of Cauchy's integral theorem, Cauchy's integral formula and Cauchy Residue Theorem – Taylor's and Laurent's expansions – Applications of residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding Poles on the real axis).

UNIT V LAPLACE TRANSFORM 9 + 6

Existence conditions – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function, impulse function and periodic function - Inverse Laplace transform – Convolution theorem (excluding Proof) –Solution of linear ODE of second order with constant coefficients.

SUPPLEMENT TOPIC (for internal evaluation only) 3

Evocation / Application of Mathematics, Arithmetical, Ability – Time and Work – Time and Distance.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Solve first and higher order ordinary differential equations analytically and apply in real life engineering problems.
- Calculate the gradients and directional derivatives of functions of several variables.
- Find the image of a region under conformal mapping and construct analytic functions using its properties.
- Apply the knowledge of standard techniques of complex variables for evaluating different functions
- Apply Laplace Transform methods to solve initial value problems for constant coefficient linear ODEs.

TEXT BOOKS:

1. VEERARAJAN.T "Engineering Mathematics" Tata McGraw Hill Publishing Company, New Delhi, vol 15.
2. BALI N. P and MANISH GOYAL, "Text book of Engineering Mathematics", Laxmi Publications (P) Ltd., New Delhi, 3rd Edition, (2008).

REFERENCE BOOKS:

1. RAMANA B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 11th Reprint, (2010).
2. KREYSZIG. E, "Advanced Engineering Mathematics", John Wiley & Sons, New York, 10th Edition, (2011).
3. JAIN R.K and IYENGAR S.R.K, "Advanced Engineering Mathematics", Narosa Publishing House Pvt. Ltd., New Delhi, 3rd Edition, (2007).
4. GERALD C.F. and WHEATELEY, P.O. "Applied Numerical Analysis", Pearson Education, New Delhi, 7th Edition, (2003).
5. AGARWAL R.S., "Quantitative Aptitude", S. Chand Publications, New Delhi, 7th Edition, (2008), pp. 341-370, 384-404.

15UPH204	SOLID STATE PHYSICS	L	T	P	C
	(Common to EEE & BME)	3	0	0	3

OBJECTIVES:

- To identify the fleet of scientific channels exploring the generation of high-tech electrical engineering materials
- To enable the students to understand the properties of superconducting and magnetic materials
- To provide a comprehensive overview of nanomaterials in terms of the synthesis, characterization, properties, and applications

UNIT I ELECTRICAL PROPERTIES OF SOLIDS 9

Introduction - Derivation of microscopic form of Ohm's law- postulates of classical free electron theory-derivation of electrical conductivity of metals (Drude- Lorentz theory)- merits and demerits. Derivation of thermal conductivity – Wiedemann-Franz law- verification - Density of energy states.

UNIT II SEMICONDUCTING AND BIOMATERIALS 9

Introduction – Direct and Indirect band gap semiconductors – Intrinsic semiconductor – carrier concentration derivation –Extrinsic semiconductor (qualitative) – Hall Effect –Determination of Hall coefficient – Applications- Introduction to Biomaterials -Properties-Types- Requirements of Biomaterials- Applications.

UNIT III MAGNETIC & SUPERCONDUCTING MATERIALS 9

Introduction– Bohr magnetron – Classification of magnetic materials – Domain theory – Hysteresis – soft and hard magnetic materials–Superconductivity: Properties - Types of super conductors – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications – SQUID – Maglev train

UNIT IV DIELECTRICS AND CERAMICS 9

Dielectric Materials: Introduction – Electrical susceptibility-Dielectric constant-Electronic, ionic, orientation and space charge polarization –Internal field – ClaussiusMosotti relation (Derivation). Ceramic Materials: Introduction - Classification – Structure – Methods of Processing – Properties – Application

UNIT V NANO MATERIALS 9

Introduction to nano materials –fabrication method- synthesis – Top-down and bottom up approach – Plasma arching- Chemical Vapour deposition - ball milling –sol gel method-properties of nanoparticles - Nanomaterial's application in Biomedical.

TOTAL(L):45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Analyze the influence of conducting materials in engineering design.
- Illustrate the electronic properties of semiconductors.
- Summarize the properties magnetic and superconducting materials.
- Get adequate knowledge about dielectrics and ceramics.
- Synthesis the processing techniques for nanomaterials – both chemical and physical approaches.

TEXT BOOKS:

1. William D. Callister, Jr. “Material Science and Engineering”, Seventh Edition, John Wiley & Sons Inc. New Delhi, 2010
2. Dr. Mani.P,“Engineering Physics II ”, Dhanam Publications, Chennai Revised Edition, 2014.
3. V. Rajendran, “Materials Science”, Tata McGraw-Hill, New Delhi, 2014.

REFERENCE BOOKS:

1. Kingery W.D., Bowen H.K. and Dr. Uhlmann, “Introduction to Ceramics’, Second Edition, Wiley and son’s, Revised Edition 2012.
2. Raghavan.V, “Material Science and Engineering”, Prentice Hall of India Private Limited, New Delhi, Revised Edition 2013.
3. Palanisamy P.K., “Engineering Physics’, Scitech Publication, Chennai, Edition, 2014.

15UCY207 ENVIRONMENTAL SCIENCES L T P C
(COMMON TO ALL) 3 0 0 3

OBJECTIVES:

- Knowing the importance of environmental science and engineering
- Understanding the concepts of ecosystem, biodiversity and impact of environmental pollution
- Awareness on value education, population and social issues

MODULE-I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – Need for public awareness – Concept of an ecosystem – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

MODULE-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.

MODULE-III FUTURE POLICY AND ALTERNATIVES 9

Future policy and alternatives-fossil fuels-nuclear energy-solar energy-wind energy-hydroelectric energy-geothermal energy-tidal energy-sustainability-green power-nanotechnology-international policy.

MODULE-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 protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation – Public awareness.

MODULE-V HUMAN POPULATION AND THE ENVIRONMENT 8

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

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Comprehend the importance of environmental impact on ecosystem and biodiversity
- Understand current environmental challenges like pollution and its management
- Remembering the fundamentals of physical and biological principles that govern the natural processes
- Perform their role in protecting the environment from social issues
- Learn the importance of population explosion and its controlling measures

TEXT BOOKS

1. Anubha Kaushik, kaushik C.P., “Environmental Science and Engineering”, Third Edition, New Age International, New Delhi, 2009.
2. Benny Joseph “Environmental Science and Engineering”, Tata Mc-Graw Hill,

   New Delhi, 2006.

REFERENCE BOOKS:

1. Gilbert M.Masters, ‘Introduction to Environmental Engineering and Science’, Pearson Education,Upper saddle River, New Jersey, 2008.
2. Miller T.G. Jr., Environmental Science”, Wadsworth Publishing Company, Belmont, California, 2005.
3. De A.K., “Environmental Chemistry”, Wiley Eastern Ltd., New Delhi, 2001.
4. Trivedi R.K., Goel P.K., “Introduction to Air Pollution”, Techno-Science Publication, Jaipur, 2005.

15UBM208 ELECTRICAL CIRCUITS ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- To know the basic laws and network theorems.
- To study the transient responses of the DC circuits.
- To analyze the three phase circuits.

UNIT I BASIC CIRCUITS ANALYSIS 9

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

UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC 9

Network reduction: voltage and current division, source transformation – star delta conversion. Thevenins and Norton & Theorem – Superposition Theorem – Maximum power transfer theorem –Reciprocity Theorem

UNIT III RESONANCE AND COUPLED CIRCUITS 9

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

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 9

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input

UNIT V ANALYSING THREE PHASE CIRCUITS 9

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

TOTAL :45 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Apply Kirchhoff's law for circuit analysis
- Calculate circuit parameters by applying DC network theorems
- Analyze transient response of DC circuits
- Compute power and power factor of three phase circuit in different configurations
- Analyze three phase voltage source with balanced and unbalanced load

TEXT BOOKS:

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

REFERENCES:

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

15UBM209	SENSORS AND MEASUREMENT TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the characteristics of the measuring systems.
- To understand the principle of various sensors.
- To analyze the bridge circuits.

UNIT I MEASUREMENT SYSTEM AND SENSOR CHARACTERISTICS 9

Measurements and generalized measurement system: Static characteristics, accuracy, precision, linearity, hysteresis, threshold, dynamic range- Dynamic Characteristics-calibration, standards, Errors- types of errors

UNIT II DISPLACEMENT, PRESSURE AND TEMPERATURE MEASUREMENT 9

Displacement and Pressure Measurement: Strain Gauge - Principle, Gauge factor, Types of Strain gauges, strain gauge as displacement & pressure transducers, Capacitive transducer, Inductive transducer- LVDT, Temperature Measurement: RTD, Thermistor, Thermocouple, IC Temperature Sensor

UNIT III PHOTOELECTRIC AND OTHER SENSORS 9

Piezoelectric transducer – Hall effect transducer -Magnetostrictive transducer- Fiber optic transducer – Digital transducers – Piezoresistive – Proximity Sensor - Smart Sensor – Introduction to MEMS and Nano Sensors

UNIT IV RECORDERS AND DISPLAY DEVICES 9

Graphic recorders – strip chart, X-Y recorder, Magnetic tape recorder – CRO basics: CRT, General purpose oscilloscope, Dual trace, Dual beam, Sampling oscilloscope, Digital storage oscilloscope.

UNIT V AC AND DC BRIDGES 9

Resistance measurement- Wheatstone bridge, Kelvin double bridge and Direct defection methods, Measurement of Inductance – Maxwell Wein bridge, Hay's bridge, Measurement of capacitance-Schering bridge

TOTAL : 45 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Discuss the static and dynamic characteristics of the measuring systems
- Explain the resistive, inductive and capacitive transducers based on their working principle
- Explain the principle and working of photo electric and photo resistive sensors
- Discuss the working of recorders and display devices
- Construct a bridge circuit for measuring Resistance and impedance and derive the expression for unknown quantity

TEXT BOOKS:

1. Patranabis D, "Sensors and Transducers", Prentice Hall of India, , 2nd Edition New Delhi 2003.
2. Doebelin, E. A, "Measurement Systems: Applications and Design", Tata McGraw-Hill, New Delhi ,second edition, 2003

REFERENCE BOOKS:

1. Patranabis D, “Principle of Industrial Instrumentation”, Tata McGraw Hill, 16thEdition, 2007.
2. Sawhney, A.K, Puneet Sawhney, “A Course in Electrical and Electronic Measurement and Instrumentation”, Dhanpat Rai & Co (P) Ltd, New Delhi , 2005
3. John P Bently, “Principles of Measurements Systems”,Pearson Education, New Delhi.,3rd Edition,2000.

15UGS210	BASIC SCIENCES LABORATORY –II	L	T	P	C
		0	0	2	1

Objectives:

- To introduce the experimental procedure for the Band gap of a semiconductor, B-H curve and Potentiometer.
- To demonstrate the working of Spectrometer and Lee's Disc apparatus.

PHYSICS LABORATORY

(COMMON TO CSE,ECE, EEE, IT, BIOMEDICAL)

LIST OF EXPERIMENTS

1. Laser – Determination of numerical aperture and acceptance angle of an optical fibre.
2. Carey Foster's Bridge – Determination of specific resistance of the given coil.
3. Spectrometer – Determination of wavelength of mercury source using grating.
4. Newton's ring – Determination of radius of curvature of Planoconvex lens.
5. B-H curve - Study of Hysteresis Loop
6. Determination of Band gap of a semiconductor.

- **A minimum of FIVE experiments shall be offered**

COURSE OUTCOMES:

After the successful completion of this course, student shall be able to

- Analyze the thermal conductivities of bad conductors and also the properties of semiconductors.
- To know the elastic properties of materials using uniform&non-uniform bending method of young's modulus.
- Understand the theory behind the signal communication through laser in optical fiber.

TOTAL: 30 Periods

CHEMISTRY LABORATORY

OBJECTIVES:

- Develop the practical skills to evaluate the quality parameters of water and industrial effluents
- Apply the theoretical principles and perform experiments**.**

LIST OF EXPERIMENTS
(Common to All Branches)

1. Estimation of hardness of water by EDTA method.
2. Estimation of alkalinity of water sample.
3. Estimation of Chloride in water sample (Argentometric method)
4. Determination of DO in water
5. Estimation of silver ion by Dichrometry
6. Determination of quality of Surface water (River/pond/lake) and Ground water (well/ bore well) with respect to Hardness, TDS, Chloride and pH.
7. Determination of acidity of industrial effluents.

Course Outcomes:

At the end of the course,the student will able to

1. Analyse the properties of water by applying the chemical concepts.
2. Determine the acid quality in the industrial effluents.

A minimum of FIVE experiments shall be offered

TOTAL: 30 Periods

15UBM211	ELECTRICAL CIRCUITS AND TRANSDUCERS LABORATORY	L T P C 0 0 2 1

OBJECTIVES:

1. To familiarize the basic electrical laws and network theorems.
2. To demonstrate the operation of strain gauge, LDR, LVDT, RTD and bridges.

LIST OF EXPERIMENTS

1. Verification of Ohm's law.
2. Verification of Kirchoff's laws.
3. Verification of Thevenin's theorem.
4. Verification of Norton's theorem.
5. Verification of Reciprocity theorem.
6. Characteristics of Strain gauge and LDR.
7. Temperature measurement using RTD.
8. Displacement measurement using LVDT.
9. Wheatstone bridge for Medium resistance measurement.
10. Schering Bridge for capacitance measurement.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Test the basic electrical laws.
- Verify the theorems using simple circuits.
- Achieve the characteristics of different transducers.
- Build the bridge circuit to measure resistance and capacitance.

SEMESTER III

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
7.	15UMA321	Transforms and Partial Differential Equations (Common to Mech, ECE, EEE, CIVIL,CHEM & BME)	3	2	0	4
8.	15UBM302	Human Anatomy and Physiology	3	0	0	3
9.	15UBM303	Biochemistry	3	0	0	3
10.	15UBM304	Biomedical Instruments	3	0	0	3
11.	15UBM305	Semiconductor Devices and Circuits	3	0	0	3
12.	15UIT327	Object Oriented Programming and Data Structures	3	0	0	3
PRACTICAL						
7.	15UBM307	Semiconductor Devices and Circuits Laboratory	0	0	2	1
8.	15UBM308	Biochemistry Laboratory	0	0	2	1
9.	15UIT328	Object Oriented Programming and Data Structures Laboratory	0	0	2	1
		Total	18	2	6	22
Total Credits : 22						

15UMA321	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (Common to MECH, ECE, EEE, CIVIL, CHEM, AGRI, BME)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To make the student knowledgeable in formulating certain practical problems in terms of partial differential equations, solve them and physically interpret the results.
- To familiarize the students to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve them numerically and interpret the results.
- To acquaint the student with the basics of Z - transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the Z - transform technique bringing out the elegance of the procedure involved.

UNIT I FOURIER SERIES 9 + 6

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 - Application of Fourier series - Gibb's Phenomenon.

UNIT II FOURIER TRANSFORM 9 + 6

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

UNIT III Z-TRANSFORM AND DIFFERENCE EQUATIONS 9 + 6

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and Final value Theorems - Formation of difference equations – Solution of difference equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

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 V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 6

Introduction of Partial differential equations - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat equation (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Write any periodic function as a combination of series of sine and cosine which are harmonically related to each other.
- Apply the acquired knowledge of Fourier transform and its properties which are used to transform signals between time and frequency domain.
- Apply the acquired knowledge of Z transform and its properties for the analysis of linear discrete systems.
- Form partial differential equation and solve linear first order and second order partial differential equations.
- Apply Fourier series to solve partial differential equations representing one dimensional and two dimensional heat and wave equations.

TEXT BOOKS:

1. GREWAL B.S, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 42nd Edition, (2012).
2. KANDASAMY.P, THILAGAVATHY.K, and GUNAVATHY.K, Engineering Mathematics III, S.Chand& Company Ltd., New Delhi, 3rd Edition, (1996).

REFERENCE BOOKS:

1. BALI N.P., MANISH GOYAL and WATAINS, "Advanced Engineering Mathematics", Firewall Media (An imprint of Laxmi Publication Private limited) New Delhi, 7th Edition, (2009).
2. RAMANA.B.V, "Higher Engineering Mathematics" Tata McGraw Hill, New Delhi, 11th Reprint (2010).
3. GLYN JAMES, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 3rd Edition, (2007).
4. ERWIN KREYSZIG, "Advanced Engineering Mathematics", Wiley India, 10th Edition, (2011).

15UBM302	HUMAN ANATOMY AND PHYSIOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To elaborate the cell structure and action potential generation
- To explainanatomy and physiology of vital organ systems.

UNIT I CELL: STRUCTURE AND FUNCTIONS 9

Cell: Different types of cells – Structure and organelles – Functions of each component in the cell – Cell division: Mitosis & Meiosis, Cell cycle and its Regulation – Locomotion of Cells – Cell membrane: transport across membrane – origin of cell membrane potential (Nernst and Goldman and Katz equations) – Action potential and propagation

UNIT II CARDIOVASCULAR AND RESPIRATORY SYSTEM 9

Cardiovascular System -Heart: Structure of the heart – Functions – Actions of the heart – Properties of cardiac muscle – Conducting system of heart – Cardiac cycle-Heart sounds-classification of circulatory system-Volume and pressure changes and regulation of heart rate

Respiratory System :Introduction – Types and phases of respiration – Breathing Mechanism – Respiratory tract – Pulmonary function – Ventilation – Regulation of respiration

UNIT III NERVOUS SYSTEM 9

Neuron – Classification of nerve fibers – Properties of nerve fibers – Synapse – Neurotransmitters – Reflex activity – Central Nervous System(CNS): Anatomy of Brain and Spinal cord – Cerebrospinal fluid (CSF) – Peripheral Nervous System: Autonomic Nervous System (ANS): Sympathetic and Parasympathetic nervous system

UNIT IV DIGESTIVE AND EXCRETORY SYSTEM 9

Digestive system: Organization of Gastro Intestinal (GI) tract – Walls of GI tract – Digestion and absorption – Movement of GI tract – Secretion of digestive fluids

Urinary system: Structure of Kidney and Nephron – Mechanism of Urine formation and acid base regulation

UNIT V SKELETAL AND SENSORY SYSTEM 9

Skeletal System :Skeletal system: Bone types and functions – Joint - Types of Joint - Cartilage and functions.

Sensory organs: Auditory (Ear), Olfactory (Nose), Ophthal (Eye), Gustatory (Taste) and Tactile (Touch)

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the basic cell structure and functions.
- Discuss the anatomy and physiology of cardiovascular and respiratory systems.
- Classify the nerve fibers and their functions.
- Explain digestion process and formation of urine in human.
- Summarize the various skeletal and sensory systems.

TEXT BOOKS

1. Arthur C, Guyton, John Hall. E “Textbook of Medical Physiology”, W.B. Saunders Company, Eleventh edition, 2006
2. K Sembulingam, PremaSembulingam “Essentials of Medical Physiology” Jaypee Brothers Medical Publishers (P) Ltd, Sixth edition, 2012

REFERENCE BOOKS

1. SaradaSubramanyam, MadhavanKutty. K and Singh. H.D, “Text Book of Human Physiology”– Chand. S & Company, First Edition,1996.
2. Ranganathan T S, “Text Book of Human Anatomy”, Chand S, & Co. Ltd., Fifth Edition,1996.
3. William F. Ganong, “Review of Medical Physiology”, 22nd Edition, McGraw Hill, New Delhi, 2005

15UBM303	BIOCHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Introduce chemical basis of life
- To explain the Classification, Structure and Properties of Carbohydrates, Lipids, Proteins and Enzymes

UNIT I BIOCHEMISTRY : CHEMICAL BASIS OF LIFE 9

Introduction: Bio-organic Chemistry- Biophysical Chemistry – Tools of Biochemistry – Biomolecules – Study of Metabolic processes – Stabilizing forces in molecules: Covalent and Ionic bonds – Principles of Thermodynamics

UNIT II ENVIRONMENTAL BIOCHEMISTRY AND GENERAL TECHNIQUES 9

Environmental Biochemistry: Atmospheric Changes – Pollution – Carcinogens – Metabolism of Nitrogen containing compounds: Nitrogen fixation, Amino acids and Nucleotides Photosynthesis,: Calvin cycle – General Techniques: Electrophoresis – Chromatography - Radioimmunoassay – ELISA test – Colorimeter – Auto-analyzer – Mass spectrometry

UNIT III METABOLISM OF CARBOHYDRATES 9

Nomenclature – Biological Functions – Classification: Monosaccharides, Disaccharides, Polysaccharides, Mucopolysaccharides, Glycoproteins and Mucoproteins – Metabolic Pathways of Glucose: Glycogen, Glycogenolysis, Glycogenesis

UNIT IV PROTEINS, AMINO AND NUCLEIC ACIDS 9

Proteins: Structure – Primary, Secondary, Tertiary, Quaternary – Properties – Denaturation - Classification – Plasma Proteins – Amino Acids: Structure – Classification – Properties – Metabolism – Peptide bond formation – Nucleic Acids: Structure of purines and pyrimidines, Nucleoside, Nucleotide, DNA act as a genetic material, Chargoffs rule. Watson and crick model of DNA. Structure of RNA and its type.

UNIT V ENZYME AND LIPID METABOLISM 9

Enzymes: Nomenclature and Classification – Chemical Nature and Properties of Enzymes – Factors affecting Enzyme activity – Mechanism of Enzyme Action – Application and Diagnostic importance of Enzymes

Lipids: Classification of lipids - Fatty acids - Saturated fatty acids - Unsaturated fatty acids - Trans fatty acids - Neutral fats - Phospholipids

Total : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain metabolic processes and principles of thermodynamics.
- Discuss environmental biochemistry and select suitable instrument to measure parameters related to it.
- Analyze the metabolism of carbohydrates.
- Summarize the structure of proteins, amino and nucleic acids.
- Classify the enzyme and lipid metabolism.

TEXT BOOKS:

1. Dr. U. Satyanarayana, “Biochemistry”, Third Revised Edition, ArunabhaSen Books and Allied (P) Ltd., 2007
2. D.M. Vasudevan,**“**Textbook of Biochemistry for Medical Students”, Jaypee Brothers Medical Publishers (P) Ltd, Seventh Edition, 2013

REFERENCES:

1. Pamela.C.Champe&Richard.A.Harvey, “Lippincott Biochemistry Lippincott’s Illustrated Reviews”, Raven publishers, 1994.
2. David.W.Martin, Peter.A.Mayes, Victor. W.Rodwell, “Harper’s Review of Biochemistry”, LANGE Medical Publications, 1981

15UBM304	BIOMEDICAL INSTRUMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce Biopotential electrodes and their configuration.
- To explain various measuring circuits for bio potentials and nonelectric parameters of various organelle

UNIT I BIO POTENTIAL ELECTRODES 9

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

UNIT II ELECTRODE CONFIGURATIONS 9

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

UNIT III BIO AMPLIFIER 9

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 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers- systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT 9

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Classifybiopotential electrodes and choose suitable electrode for different biopotential measurement.
- Discuss the electrode configurations of ECG, EEG and EMG.
- State the role and choice of bio amplifiers.
- Elaborate the measurement of non electrical parameters.
- Choose the appropriate instrument to measure bio chemical parameters and explain the procedure.

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

15UBM305 SEMICONDUCTOR DEVICES AND CIRCUITS L T P C

3 0 0 3

OBJECTIVES:

- To provide the information of working of various semi conduction devices
- To explain the concept of amplifiers and oscillators using transistors
- To familiarize the functioning of power supply circuits

UNIT I SEMICONDUCTOR DIODE AND BJT 9

PN Junction – Current components in a PN diode – Junction capacitance – Junction diode switching time – Zener diode – Varactor diode – Tunnel diode – Schottky diode – Transistor Structure – Basic Transistor operation – Transistor characteristics and parameters – The transistor as a switch– Transistor bias circuits:- Voltage divider bias circuits, base bias circuits, emitter bias circuts – DC load line – AC load line- bias stabilization, thermal runaway and thermal stability.

UNIT II FET, UJT and SCR 9

JFET characteristics and parameters – JFET biasing, self bias, voltage divider bias – Q point– MOSFET characteristics and parameters –Characteristics of UJT, SCR

UNIT III AMPLIFIERS 9

CE amplifiers - Small signal low frequency transistor amplifier circuits – h parameter representation of a transistor - Analysis of single stage transistor amplifier using parameters voltage gain, current gain, input impedance, output Admittance and frequency response -power amplifiers: Class A,B,AB (Qualitative analysis).

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Advantages of negative feedback - Voltage/current, series/shunt feedback-Positive feedback - Condition for oscillators - Phase shift - Wein Bridge – Hartley - Colpitts and crystal oscillators.

UNIT V PULSE CIRCUITS AND REGULATORS 9

RC wave shaping circuits - Diode clampers and clippers – Multivibrators – Astable and Monostable multivibrators - Schmitt triggers - UJT - Saw tooth oscillators - Single phase rectifiers and analysis of filter circuits - Design of zener and transistor series voltage regulators.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Explain the operation & characteristics of diodes & bipolar junction transistor
- Explain the operation & characteristics of various types of FET, UJT and SCR
- Analyze the working of a amplifiers
- Explain circuits for oscillators and feedback amplifier using transistors
- Analyze the pulse wave shaping circuits for regulators

TEXT BOOKS :

1. Millman and Halkias, „Electronic Devices and Circuits", Tata McGraw – Hill, 2007.
2. Floyd, T.L, „Electronic Devices" 7th Edition, Pearson Education, 2008

REFERENCES :

1. Millman, J., Prakash Rao., M.S. and Taub, H., „Pulse Digital and Switching Wave Forms", McGraw-Hill, 2nd Edition, 2007.
2. Streetman, B. and Sanjay, B., „Solid State Electronic Devices", Prentice- Hall of India, 5th Edition, 2005.
3. Mottershead, A., „Electronic Devices and Circuits an Introduction', Prentice Hall of India, 2003.
4. Boylsted and Nashelsky, „Electronic Devices and Circuit Theory', Prentice Hall of India, 6th Edition, 1999.
5. Bell, D.A., „Electronic Devices and Circuits", Prentice Hall of India, 4th Edition, 1999.

		L	T	P	C
15UIT327	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES (DEPARTMENT OF BME)	3	0	0	3

COURSE OBJECTIVE:

- To review the basic concepts of OOPs
- To explain the systematic way of solving problems using various data structures
- To demonstrate implement the different data structures

UNIT I PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 9

Introduction – Tokens – Expressions-Control Structures-Functions in C++, Classes and Objects, Constructors and Destructors, Operator overloading.

UNIT II ADVANCED OBJECT ORIENTED PROGRAMMING 9

Inheritance-Extending classes, pointers, virtual functions and polymorphism, File Handling, Exception handling.

UNIT III LINEAR DATA STRUCTURES 9

Algorithm Analysis, Abstract Data Types, Lists, Stacks – Applications - Queues – Circular queue – Double ended queue - Priority queues **(**Heaps)

UNIT IV NON-LINEAR DATA STRUCTURES 9

Trees-Binary trees, Search tree ADT, AVL trees, Graph Algorithms - Topological sort and Shortest path algorithm – Dijkstra's Algorithm – Minimumspanning tree.

UNIT V SEARCHING, SORTING AND HASHING 9

Searching: Linear search – Binary Search – Sorting: Bubble Sort, Insertion sort, Selection Sort, Shell sort, Merge sort, Quick sort, Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the principles of Object Oriented Programming
- Demonstrate exception handling mechanisms to handle runtime errors
- Design and implement an appropriate data structure for various applications
- Identify the suitable non-linear data structures to solve real time problems
- Implement appropriate various searching and sorting techniques

TEXT BOOKS:

1. E.Balagurusamy,"Object oriented programming with C++", Tata McGrawHill, 6th Edition,2013.
2. Weiss. M.A,"Data Structures and Algorithm Analysis in C++ ", Pearson Education, 4th Edition,2014.

REFERENCE BOOKS:

1. Stroustrup.B,"The C++ Programming language ", Pearson Education, 4th Edition,2013.
2. Aho.V, Hopcroft.J.E, Ullman.J.D,"Data Structures and Algorithms", Pearson Education, 1st Edition Reprint,2006.
3. Varsha H. Patil,"Data Structures using C++", Oxford University Press,1stEdition,2012.
4. Gilberg.R.F, Forouzan.B.A,"DataStructures:APseudo code Approach with C++", Thomson India Education, 2nd Edition,2005.

15UBM307 SEMICONDUCTOR DEVICES AND CIRCUITS LABORATORY L T P C

0 0 2 1

OBJECTIVES:

- To demonstrate the characteristics various electronic devices
- To introduce simulation software to implement electronic circuits

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode
2. Characteristics of Zener diode.
3. Characteristics of Transistor using CE and CB configurations.
4. Characteristics of JFET
5. Characteristics of Photo diode, phototransistor.
6. Differential amplifier using FET.
7. Realization of Passive filters.
8. Simulate and study resistance impact under series and parallel connection using Circuit Simulator software.
9. Simulate and study of Common Emitter amplifier using Circuit Simulator software.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

After successful completion of this course the students will be able to:

- Realize the working of diodes and transistors
- Characterize the features of photo diode and photo transistors
- Simulate the functioning of resonance and amplifier circuits.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the experiment	Range/ Specification	Quantity Required
1.	Regulated Power Supply	0-30V.2A	10
2.	Dual Tree CRO (20 MHz)	30MHZ	3
3.	Function Generator	3MHZ	3
4.	31/2 Digit digital multimeter	500mA/250V	8
5.	Bread Boards	-----	20
6.	Transistor	BC107	25
7.	JFET	BFW 10	10
8.	Diode	IN 4007	10
9.	Zener Diode	Z10	5
10.	UJT	ZN 2646	5
11.	Photo Diode	LED55C	5
12.	Photo Transistor	BPX38	5
13.	Milli Ammeter (0-100mA)	0-100mA,0-50mA , 0-30mA	15
14.	Micro Ammeter (0-50μA)	(0-100mA) (0-50mA)	10
15.	Low range voltmeter (0-30V)	(0-10V) (0-1 V)	10
16.	Resistor of various ranges	1K,10K,68K,4.7K	50
17.	Capacitors of various ranges	0.1μF	50
18.	SCR	TYN616	Each 5

15UBM308	BIOCHEMISTRY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

To provide practice on:

- Estimation and quantification of biomolecules
- Separation of macromolecules

LIST OF EXPERIMENTS:

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

TOTAL : 30 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Identify availability of carbohydrates, proteins and lipids in given sample
- Estimate the blood glucose, creatinine, urea and cholesterol
- Separate the proteins and amino acids by conducting suitable experiments
- Estimate the ESR , PCV, MCH , MCV ,MCHC , total count of RBCs and hemoglobin estimation

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

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

15UIT328	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES LABORATORY (DEPARTMENT OF BME)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To demonstrate the basic concepts of Object Oriented Programming
- To demonstrate different data structures
- To demonstrate the various sorting techniques

LIST OF EXPERIMENTS

1. Implement Operator overloading
2. Implement Classes with constructor, destructor and copy constructor
3. Implement Classes with inheritance concepts
4. Implement Templates & Manipulating string
5. Stack ADT - Array and Linked list implementations
6. Queue ADT – Array and Linked list implementations
7. Implement Search Tree ADT - Binary Search Tree
8. Implement insertion and Deletion in AVL trees
9. Implement Merge Sort
10. Implement Quick Sort

COURSE OUTCOMES:

After the successful completion of the course, the students will be able to

- Apply the basic knowledge of object oriented programming
- Design programs using linear and nonlinear data structures
- Demonstrate application programs using trees
- Resolve the issues in arranging the given data using sorting techniques
- Measure the space and time complexity for an algorithms

HARDWARE AND SOFTWARE REQUIRMENTS

Computer Required: 30 No's

Minimum Requirement: Processor: Pentium IV, Ram: 1 GB, Hard Disk: 80 GB

Software Requirements:

Operating System: Linux (Ubuntu / Fedora / Debian / Mint OS) / Windows

Turbo C Version 3 or GCC Version 4 / Built in Linux / DEVC++

SEMESTER IV

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UMA424	Probability and Random Processes (Common to ECE& BME)	3	2	0	4
2.	15UBM401	Analog and Digital Integrated Circuits	3	0	0	3
3.	15UBM403	Medical Physics	3	0	0	3
4.	15UBM404	Principles of Signals and Systems	3	0	0	3
5.	15UBM405	Pathology and Microbiology	3	0	0	3
6.	15UBM406	Diagnostic and Therapeutic Equipments – I	3	0	0	3
7.	15UGS431	Reasoning and Quantitative Aptitude (Common to ALL)	1	0	0	1
PRACTICAL						
8.	15UBM407	Analog and Digital Integrated Circuits Laboratory	0	0	2	1
9.	15UBM408	Pathology and Microbiology Laboratory	0	0	2	1
		Total	19	2	4	22
Total Credits : 22						

15UMA424	PROBABILITY AND RANDOM PROCESSES (Common to ECE & BME)	L	T	P	C
		3	2	0	4

OBJECTIVES :

- To provide necessary basic probability concepts and standard distributions that can describe real life phenomena.
- To make the student acquire skills in handling situations involving more than one random variable and functions of random variables.
- To make the student understand and characterize phenomena which evolve with respect to time in probabilistic manner.
- To familiarize the student to analyze the response of random inputs to linear time invariant systems.

UNIT I RANDOM VARIABLES 9 + 6

Axioms of probability - Conditional probability - Total probability – Baye's theorem - Random variable - Probability mass function - Probability density functions- Properties – Moments - Moment generating functions and their properties - Binomial, Poisson, Normal, Geometric, Uniform, Exponential and Gamma distributions.

UNIT II TWO DIMENSIONAL RANDOM VARIBLES 9 + 6

Joint probability distributions – Marginal and Conditional distributions – Covariance – Correlation and Regression – Transformation of random variables.

UNIT III CLASSIFICATION OF RANDOM PROCESSES 9 + 6

Classification - Stationary Process - Markov Process - Poisson Process - Random Telegraph Process – Markovianqueueing system (M/M/1).

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9 + 6

Auto Correlation Functions - Cross Correlation Functions – Properties - Power Spectral density - Cross spectral density - Applications of correlations and Spectral Densities.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9 + 6

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

TOTAL : 45 (L) + 30 (T) = 75 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Apply the acquired knowledge of standard distributions in real life phenomena**.**
- Find the relationship involving more than one random variable and analyze the functions.
- Apply the acquired fundamental mathematical knowledge on correlation, spectral density and power spectrum which is used in communication systems and control systems in their higher classes.
- Apply the acquired fundamental knowledge on random process to analyse the linear system with random inputs in the areas of communication and signal processing
- Apply basic probability techniques and models to analyze the performance of systems.

TEXT BOOKS:

1. VEERARAJAN, "Probability and Random Processes”, 4 th edition, 2015.
2. OLIVER C. IBE, “Fundamentals of Applied probability and Random processes”, Elsevier, Lowell, Massachusetts, 1st Indian Reprint, (2007).

REFERENCE BOOKS:

1. YATES. R.D. and GOODMAN. D.J., "Probability and Stochastic Processes", Wiley India, Bangalore, 2nd Edition, (2012).
2. STARK. H., and WOODS. J.W., "Probability and Random Processes with Applications to Signal Processing", Pearson Education, Asia, 3rd Edition, (2002).
3. HWEI HSU, "Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill, New Delhi, 1st Edition, (2004).
4. SIMON HAYKIN, “Communication Systems”, John Wiley and Sons, New Delhi, 7th Edition, (2007).
5. PEEBLES. P.Z., "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, New Delhi, 4th Edition, (2002).
6. GROSS D, and HARRIS C.M., “Fundamentals of Queuing Theory”, Wiley Students, India, 3rd Edition, (2004).

15UBM401	ANALOG AND DIGITAL INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the theory and characteristics of Op-Amp
- To discuss the application of analog ICs in the designing circuit
- To familiarize the concepts of Boolean algebra
- To design combinational , sequential circuits using gates and Memory devices

UNIT I OPERATIONAL AMPLIFIER FUNDAMENTALS AND BASIC APPLICATIONS 9

Introduction – Ideal Op-amp circuit – DC characteristics, AC characteristics – Basic Op-amp application, Instrumentation amplifier, V to I and I to V converter, Clipper, Clamper, Sample and hold, Log amplifier, Differentiator, Integrator

UNIT II ADVANCED APPLICATIONS OF OP-AMP 9

Comparator – Multivibrators and Schmitt trigger – Sine wave and Triangular wave generator – 1^{st} and 2^{nd} order Low pass and High pass filters – A/D converters – Flash A/D, Successive approximation A/D - D/A converter - weighted resistor type, R-2R ladder.

UNIT III SPECIAL ICs 9

IC555 Timer – Functional block description – Monostable and Astable multivibrator operations – PLL – Basics, Phase detector/comparator, Voltage controlled oscillator – Monolithic PLL – PLL applications: Frequency Multiplication/Division, and FSK Demodulation – Analog multiplier ICs

UNIT IV BOOLEAN ALGEBRA AND COMBINATIONAL CIRCUITS 9

Number Systems – Code conversions – Logic gates: Truth tables – NOT, AND,OR, NOR, NAND, XOR, XNOR – implementation of combinational logic functions: Boolean Algebra – Demorgans Theorem, SOP, POS, Karnaugh map, Quine - Mclusky method, Half/Full adder, Half/full subtractor, Encoder, Decoder, Multiplexer, Demultiplexer

UNIT V SEQUENTIAL CIRCUITS and MEMORY DEVICES 9

Sequential Circuits: Flip flops: SR, JK, T, D and Master slave – Characteristic, excitation tables, Level and Edge Triggering – Asynchronous counter – Synchronous counter, Shift registers-Memory Devices: Classification of memories, RAM organization, ROM organization, Flash memory, Combinational PLD's, PLA, PAL, PAL

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the characteristics and fundamentals of op-amp.
- Design application circuits using opamp.
- Discuss the operations of different types of special ICs.
- Implement the combinational logic functions using ICs.
- Summarize the various sequential circuits operations and classify the different types of memory devices.

TEXT BOOKS:

1. D. Roy Choudhary, Sheil B.Jani, “Linear Integrated Circuits”, II edition, New Age International, New Delhi, 2008
2. Morris Mano, M., Digital Design, Prentice Hall of India Pvt. Ltd., 3rd edition, 2003

REFERENCE BOOKS:

1. Gayakwad A.R, Op-Amp and “Linear Integrated circuits”, Prentice Hall of India, 7th edition, 2011
2. Jacob Millman, Christos C.Halkias, “Integrated Electronics – Analog and Digital circuits system”, Tata McGraw Hill, 2003
3. Donald P.Leach, Albert Paul Malvino, Digital Principles and Applications, Tata McGraw Hill , 5th edition, 2003
4. Jain. R. P., Modern Digital Electronics, Tata McGraw Hill publishing company limited, New Delhi, 4th edition, 2010

15UBM403	MEDICAL PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basics of Medical Physics
- To familiarize with ionizing and non-ionizing radiation, radioisotopes and its biological protection standards

UNIT I INTRODUCTION TO MEDICAL PHYSICS 9

Light:Physics of light - Intensity of light – Limits of Vision – Colour Vision - Sound: Physics of sound – Normal sound levels – Theories of hearing – Defects of hearing - Dosimetry: Radiation Types – Dose Quantities and Units – Radiation Protection

UNIT II IONIZING RADIATION: DOSE AND EXPOSURE 9

Introduction - Absorption, Scattering and Attenuation of Gamma-rays – Biological effects and protection – Dose and exposure measurement – Maximum permissible levels – Measurement methods - Dose measurement during radiography – Health Effects of Radiation Exposures: Stochastic Effects – Deterministic Effects – Irradiation in Pregnancy – Radiation Sickness and Tissue Sensitivities

UNIT III NON-IONIZING ELECTROMAGNETIC RADIATION 9

Introduction and Overview – Tissue as a leaky dielectric – Relaxation processes – Low and High Frequency Effects – Measurement of Ultraviolet Radiation – Electromedical Equipment Safety Standards – Measurement of Tissue Anisotropy – Energetics of Nuclear Reactions

UNIT IV RADIOISOTOPES AND NUCLEAR MEDICINE 9

Introduction – Atomic Structure - Production of Isotopes – Principles of Measurement – Principles and Examples of Non-imaging investigation– Electrical Impedance Tomography (EIT)- Table of Applications – Biomedical Laser: Interaction and Effects of UV-IR Laser Radiation on Biologic Tissues - Penetration and Effects of UV-IR Laser Radiation into Biologic Tissues - General Description and Operation of Lasers - Biomedical Laser Beam Delivery Systems

UNIT V RADIATION PROTECTION PERSONNEL 9

Introduction - Radiation accidents and environmental radiation exposure - Diagnosis and medical management of radiation syndromes - Radiation carcinogenesis -Heritable radiation effects - Effects on the developing embryo - System for radiation protection – Occupational Radiation Protection

Total : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Discuss the physics of light and sound
- Explain the properties of ionization radiation, doses and exposure
- Summarize the physics of non ionizing electromagnetic radiation on tissue
- Analyze the atomic structure , principles of measurements and effect on tissues of radio isotopes
- Practice radiation protection methods and explain causes of radiation

TEXT BOOKS:

1. B. H. Brown & R H Smallwood, “Medical Physics & Physiological Measurements”, Blackwell Scientific Publications, 1981.
2. Gyorgy J. Koteles, BelaKanyar, Kathleen M. Thiessen, “Radiation Biology and Radiation Protection”, Vol II
3. Steve Forshier, “Essentials of Radiation Biology and Protection” Second Edition

REFERENCES:

1. W.J. Meredith & J.B. Massey, Fundamental Physics of radiology, Varghese Publishing House, Bombay, 1992.
2. John R Cameron, J.G. Skofronick, Medical Physics, John Wiley & sons 1997.
3. Webb, S. (ed) The Physics of Medical Imaging, Institute of Physics Publishing, Bristol, 1992.

15UBM404	PRINCIPLES OF SIGNALS AND SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain classifications, properties of signal & systems
- To introduce Laplace Transform &Fourier transform, Z transform and their properties
- To characterize LTI systems in the Time domain and various Transform domains

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - CT systems and DT systems- Classification of systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal &Noncausal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series analysis-spectrum of Continuous Time (CT) signals- Fourier and Laplace Transforms in CT Signal Analysis - Properties.

UNIT III LINEAR TIME INVARIANT- CONTINUOUS TIME SYSTEMS 9

Differential Equation-Block diagram representation-impulse response, convolution integrals-Fourier and Laplace transforms in Analysis of CT systems

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband Sampling - DTFT – Properties of DTFT - Z Transform – Properties of Z Transform

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Difference Equations-Block diagram representation-Impulse response - Convolution sum-Discrete Fourier and Z Transform Analysis of Recursive & Non-Recursive systems

Total : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Classify Signals and Systems
- Prove the properties of Z transform and DTFT
- Apply Laplace transform, Fourier transform, Z transform and DTFT in signal analysis
- Analyze continuous time LTI systems using Fourier and Laplace Transforms
- Analyze discrete time LTI systems using Z transform and DTFT

TEXT BOOK:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2007.

REFERENCES:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”,Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
4. M.J.Roberts, “Signals & Systems Analysis using Transform Methods & MATLAB”, Tata McGraw Hill, 2007.

15UBM405	PATHOLOGY AND MICROBIOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To discuss the structural and functional aspects of living organisms.
- To explain the etiology and remedy in treating the pathological diseases

UNIT I CELL DEGENERATION, REPAIR AND NEOPLASIA 9

Cell injury and Necrosis, Apoptosis – Intracellular accumulations – Pathological calcification – Cellular adaptations of growth and differentiation – Inflammation and Repair including fracture healing – Neoplasia classification – Benign and Malignant Tumours, Carcinogenesis – Spread of tumours, Autopsy and Biopsy

UNIT II MICROSCOPES AND MICROBIAL CULTURE 9

Light microscope – Bright field, Dark field, Phase contrast, Fluorescence, Electron microscope (TEM & SEM) – Preparation of samples for electron microscope – Staining methods: Simple, Gram staining and AFB staining – Pure culture techniques – Theory and practice of Sterilization –Microbial Nutrition – Enrichment culture techniques for isolation of microorganisms

UNIT III FLUID AND HEMODYNAMIC DERANGEMENTS 9

Fluid and hemodynamic derangements: Edema, Normal Hypostasis, Thrombosis, Disseminated Intravascular Coagulation, Embolism, Infarction, Hematological disorders-Bleeding disorders, Leukaemias, Lymphomas. Bacteria, Archea and their broad classification – Eukaryotic microbes: Yeasts, molds and protozoa – Viruses and their classification

UNIT IV MICROBIAL GENETICS 9

Types of Mutation: UV and chemical mutagens – Selection of mutants – Ames test for mutagenesis – Bacterial genetic system: Transformation, Conjugation, Transduction, Recombination, Plasmids, Transposons – DNA repair – Regulation of gene expression: Operon model – Bacterial genome with special reference to E.coli – RNA phages – RNA viruses – Retroviruses – Basic concept of microbial genomics

UNIT V IMMUNOLOGY 9

Natural and artificial immunity – Opsonization – Phagocytosis – Inflammation – Immune deficiency syndrome – Antibodies and its types – Antigen and antibody reactions – Immunological techniques: Immune diffusion, Immuno electrophoresis – Monoclonal antibodies – Disease caused by Bacteria, Fungi, Protozoal, Virus and Helminthes

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the cell degeneration, repair and neoplasia.
- Describe the different types of microscopes and staining methods.
- Classify the microbial diseases.
- Summarize the types of microbial diseases.
- Discuss the basics of immunology.

TEXT BOOKS:

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

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.

15UBM406	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS – I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the working of diagnostic equipment of cardiac, neurological and muscular skeletal system.
- To familiarize the patient monitoring and biotelemetry system.
- To introduce the extra corporeal devices and diagnostics techniques

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, functioning of bubble, disc type and membrane type oxygenerators,finger pump, roller pump, electronic monitoring of functional parameter. HemoDialyser unit,Lithotripsy, Principles of Cryogenic technique and application, Endoscopy, Laproscopy,Thermography – Recording and clinical application, ophthalmic instruments.

Total : 45 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the principle and working of cardiac equipment.
- Explain the principle and working of neurological equipments.
- Explain the principle and working of skeletal muscular equipment
- Explain the patient monitoring and telemetry system.
- Discuss the need and use of some of the extracorporeal devices

TEXT BOOKS:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 2003.
2. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Pearson Education, New Delhi, 2007.

REFERENCES:

1. L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, 3Edition, 2008
2. Antony Y.K.Chan, ”Biomedical Device Technology, Principles and design”, Charles Thomas Publisher Ltd, Illinois, USA, 2008.
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson education, 2004.
4. John G.Webster, “Medical Instrumentation Application and Design”, third edition, John Wiley and Sons, New York, 2006.

15UGS431	REASONING AND QUANTITATIVE APTITUDE (Common to ALL Branches)	L	T	P	C
		1	0	0	1

OBJECTIVES :

- To make the student acquire sound knowledge of the characteristic of quantitative and qualitative aptitude.
- To familiarize the student with various principles involved in solving mathematical problems.
- To develop an understanding of the basic concepts of reasoning skills.

UNIT I QUANTITATIVE APTITUDE 8

Numbers – HCF and LCM - Arithmetic and Geometric Progression – Averages –Percentages – Problems on ages – Profit and Loss – Simple and Compound Interest - Ratio and Proportion – Time – Speed –Distance- Work – Pipes and Cistern – Problems on Trains – Permutation and Combination – Clocks – Calendars.

UNIT II VERBAL AND NON VERBAL REASONING 7

Analytical Reasoning – Circular and Linear arrangement – Direction problems – Blood relations – Analogy – Odd Man Out – Venn Diagrams – Statement and Conclusion, Statement and Implications – Letter series & arrangement – Alpha Numeric Series – Syllogism - Coding – Decoding.

TOTAL = 15 Periods

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Solve the problems on commercial mathematics.
- Solveproblems on Ratio and Proportions.
- Choose appropriate statistical tools for data analysis.
- Interpret the graphical and numerical data.
- Solve many Brain Teasers problems.

WEBSITES:

www.tcyonline.com , www.m4maths.com, www.indiabix.com , www.fresherworld.com, www.careerbless.com

TEXT BOOKS:

1. Dr. R.S.AGARWAL, “Quantitative Aptitude”, S. Chand Publications, New Delhi, 17th Edition, (2010).
2. TRISHNA KNOWLEDGE SYSTEMS, “Quantitative Aptitude”, Pearson Education, South Asia, 2nd Edition, (2009).

REFERENCES:

1. ABIJIT GUHA, “Quantitative Aptitude for Competitive Examinations”, Tata McGraw Hill Publication, New Delhi, 4th Edition, (2011).
2. Dr.V.A.SATHGURUNATH’S “A Guide for Campus Recruitment”, Sagarikka Publications, Thiruchirapalli, 3rd Edition, (2011).
3. NISHIT K.SINHA “Quantitative Aptitude for CAT”, Pearson Publication, New Delhi, 2nd Edition, (2009).
4. Dr.N.K.SINGH, “Quantitative Aptitude Test”, UpkarsPrakashan Publications, Agra, Revised Edition, (2013).

15UBM407 ANALOG AND DIGITAL INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To relate the theory concept of Boolean operation, coder and converters
- To expose the operation of counters and registers
- To familiarize on working of amplifiers and oscillators

LIST OF EXPERIMENTS:

1. Verification of Logic Gates and Flip-flops.
2. Implementation of Boolean Functions, Adder/ Subtractor circuits.
3. (a)Code converters, Parity generator and parity checking, Excess-3, 2s Complement, Binary to Gray code using suitable IC"s. (b)Encoders and Decoders: Testing of encoders and decoders using suitable ICs.
4. Counters: Design and implementation of 4-bit modulo counters as synchronous and Asynchronous types using FF IC"s and specific counter IC.
5. Shift Registers: Design and implementation of 4-bit shift registers in SISO, SIPO, PISO, PIPO modes using suitable IC"s.
6. Multiplex & De-multiplex: Study of 4:1; 8:1 multiplexer and Study of 1:4; 1:8 demultiplexer.
7. Timer IC application: Study of NE/SE 555 timer in Astable, Monostable operation.
   Application of Op-Amp:
8. Slew rate verifications, inverting and non-inverting amplifier, Adder, comparator, Integrator and Differentiator, Instrumentation Amplifiers, V/I & I/V converter.
9. Study of ADC and DAC: Verification of A/D conversion using dedicated IC"s.
10. Design of op-amp based oscillators: Square wave oscillator.
11. Study of VCO and PLL ICs
    i. Voltage to frequency characteristics of NE/ SE 566 IC.
    ii. Frequency multiplication using NE/SE 565 PLL IC.

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Verify the logic gates and implement the flip flops, Boolean functions, Code converters, Parity Checker/Generators.
- Implement the Encoder-Decoder, 3 bit up/down counter, Shift registers, Multiplexer and Demultiplexer using flip flops.
- Realize the arithmetic and comparator circuits using Op-Amps.
- Design and verify the Multivibrators, D/A and A/D convertors using dedicated IC's.

HARDWARE REQUIREMENT:

Sl. No.	Name of the equipment	Quantity required
1	CRO and function generator	3 each
2	IC trainer Kit	15
3	Analog AC trainer kit	4
4	Components and bread boards	10 each
5	Chips IC – 7400	10
6	Chips IC – 7402	10
7	Chips IC – 7408	10
8	Chips IC – 7432	10
9	Chips IC – 7410	25
10	Chips IC – 555	10
11	Chips IC – 741	10
12	Chips IC – 74153	10
13	Chips IC – 7474	10
14	Chips IC – 7490	10
15	Chips IC – 7447	10
16	Chips IC – 7476	10
17	Chips IC – 7420	10
18	Chips IC – 7404	15
19	7 segment Display	5
20	Work tables	15

15UBM408	PATHOLOGY AND MICROBIOLOGY LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

To provide practice on:

- Use of Compound microscope
- Chemical examinations, Cryoprocessing, Histopathological examinations

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. Simple stain
8. Gram stain
9. AFB stain
10. Bleeding time and clotting time
11. Study of bone marrow charts
12. Haematology slides of anemia and leukemia

TOTAL : 30 PERIODS

COURSE OUTCOMES

After the successful completion of this course, the student will be able to

- Analyze physical and chemical composition of urine.
- Demonstrate the defined skill set of microscopy, sample preparation and staining procedures.
- Differentiate the various cells in the blood smear.
- Analyze the cryoprocessing and preservation of tissue sample.

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

Wax dispenser	:	1 No
Slide warming	:	1 No
Microtome	:	1 No
Microphotographic unit	:	1 No
Slides	:	1 box
Cover slip	:	1 box

Distillation Unit	:	1 No
Water bath normal	:	1 No
Incubator	:	1 No
Autoclave	:	1 No
Oven	:	1 No
Bone marrow charts	:	1 No
Microscope	:	1 No

SEMESTER V						
S.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	**15UBM501**	**Microprocessor and Controller**	**3**	**0**	**0**	**3**
2.	**15UBM502**	**Diagnostic and Therapeutic Equipments – II**	**3**	**0**	**0**	**3**
3.	**15UBM503**	**Bio Control System**	**3**	**2**	**0**	**4**
4.	**15UBM504**	**Principles of Digital Signal Processing**	**3**	**0**	**0**	**3**
5.	**15UBM902**	**Clinical Engineering**	**3**	**0**	**0**	**3**
6.	**15UBM920**	**Cancer Biology**	**3**	**0**	**0**	**3**
PRACTICAL						
7.	**15UBM507**	**Microprocessor and Controller Laboratory**	**0**	**0**	**2**	**1**
8.	**15UBM508**	**Signal Processing Techniques Laboratory**	**0**	**0**	**2**	**1**
9.	**15UBM509**	**Diagnostic and Therapeutic Equipments Laboratory**	**0**	**0**	**2**	**1**
		Total	**18**	**2**	**6**	**22**
Total Credits : 22						

15UBM501	MICROPROCESSOR AND CONTROLLER	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the architecture, addressing modes and instruction set of 8085 and 8086, 8051
- To develop skill in simple program writing for 8085 and 8051 applications.
- To introduce commonly used peripheral / interfacing ICs.

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

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

UNIT II ASSEMBLY LANGUAGE PROGRAMMING **9**

8085: Assembly Language Programming, programming techniques, Subroutines, serial I/O and data communication, Interrupts, Interrupt programming, 8086: Simple Assembly Language Programming, Assembler Directives- Interrupts and Interrupt Applications.

UNIT III MICROCONTROLLER 9

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

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

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

UNIT V ARM PROCESSOR AND PIC MICROCONTROLLER **9**

Arcon RISC Machine – Core & Architectures - ARM processor family – Co-processors- ARM Register set – PIC Microcontroller Architecture–memory organization–addressing modes–instruction set.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Describe the architecture of 8085 and 8086.
- Understand the addressing modes, instruction set and write programs of 8085 and 8086.
- Apply the concept of programming in interface applications.
- Elaborate the architecture of 8051
- Explain ARM Processor and PIC microcontroller system design.

TEXTBOOKS:

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

REFERENCES:

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

15UBM502	DIAGNOSTIC AND THERAPEUTIC EQUIPMENTS – II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basics of diagnostics techniques
- To discuss the working and application of diagnostic equipments related to respiratory and sensory system.
- To familiarize the patient safety system.

UNIT I ULTRASONIC TECHNIQUE 9

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

UNIT II RESPIRATORY MEASUREMENT STSTEM 9

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

UNIT III SENSORY MEASUREMENT 9

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

UNIT IV DIATHERMY 9

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

UNIT V PATIENT SAFETY 9

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

Total : 45 Periods

COURSE OUTCOMES:

At the end of the course the students will be able to

- Discuss ultrasound imaging techniques and its usefulness in diagnosis
- Explain about measurements of parameters related to respiratory system
- Describe the measurement techniques of sensory responses
- Analyze different types and uses of diathermy units
- Outline the importance of patient safety against electrical hazard

TEXT BOOKS:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw Hill, New Delhi, 2003.
2. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Pearson Education, New Delhi, 2007.

REFERENCES:

1. L.A Geddes and L.E.Baker, “Principles of Applied Biomedical Instrumentation”, 3Edition, 2008
2. Antony Y.K.Chan, ”Biomedical Device Technology, Principles and design”, Charles Thomas Publisher Ltd, Illinois, USA, 2008.
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, Pearson education, 2004.
4. John G.Webster, “Medical Instrumentation Application and Design”, third edition, John Wiley and Sons, New York, 2006.

15UBM503	BIO CONTROL SYSTEM	L	T	P	C
		3	2	0	4

OBJECTIVES:

- To discuss system concept and different mathematical techniques to model engineering systems
- To derive time domain and frequency domain specifications.
- To practice the techniques of plotting the responses in both domain analysis.
- To apply modeling concepts to biological systems.

UNIT I CONTROL SYSTEM MODELLING 9+6

System concept – Differential Equations, Transfer functions – Modeling of Electrical and Mechanical systems – Electrical analogy of mechanical systems – Signal flow graphs – Conversion of Block diagram to Signal flow graph.

UNIT II TIME RESPONSE ANALYSIS 9+6

Time Response – Test inputs – Type and order of systems – Step and Impulse response of first order and second order systems – Time domain specifications – Steady state errors.

UNIT III FREQUENCY RESPONSE ANALYSIS 9+6

Frequency response – Bode plot – Polar plot – Frequency domain specifications from the plots – transfer function from bode plot – Correlation between time and frequency response.

UNIT IV STABILITY ANALYSIS 9+6

Definition of stability – Routh-Hurwitz criteria of stability – Root locus technique – Construction of root locus and study of stability – Nyquist stability criterion (System with transportation lag excluded)

UNIT V PHYSIOLOGICAL CONTROL SYSTEM 9+6

Example of physiological control system – Difference between engineering and physiological control systems – Generalized system properties – Models with combination of system elements – Linear models of physiological systems: Cardiovascular system.

TOTAL : 45(L)+30(T) = 75 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Formulate mathematical models for given control system problems.
- Analyze the behaviour of system in time domain using different mathematical techniques.
- Analytically quantify the frequency domain behaviour of dynamic systems.
- Analyze the stability of systems using analytical and graphical methods.
- Create simple models of the physiological system.

TEXT BOOKS:

1. M. Gopal “Control Systems Principles and Design”, Tata McGraw Hill, 2002
2. Michael C K Khoo, “Physiological Control Systems”, IEEE Press, Prentice Hall of India, 2001

REFERENCES:

1. Benjamin. C.Kuo, ' Automatic Control Systems', Prentice Hall of India, 1995.
2. Manfreclyner and John H.Milsum, Bio Medical engineering system, McGraw-Hill and Co., NewYork, 1970.
3. John Enderle Susan Blanchard, Joseph Bronzino “Introduction to Biomedical Engineering”, second edition, Academic Press, 2005.
4. Richard C. Dorf, Robert H. Bishop, “Modern control systems”, Pearson, 2004.

15UBM504 PRINCIPLES OF DIGITAL SIGNAL PROCESSING L T P C
3 0 0 3

OBJECTIVES:

- To learn discrete Fourier transform and its properties
- To introduce the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals
- To discuss Finite word length effects
- To introduce the concept of Multirate and adaptive filters

UNIT I DISCRETE FOURIER TRANSFORM 9

Review of discrete time signals & systems – DFT and its properties, Properties of DFT – Circular Convolution – FFT Algorithms – Decimation in time Algorithms, Decimation in frequency Algorithms – Radix 2 method.

UNIT II IIR FILTER DESIGN 9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF) filter design using frequency translation

UNIT III FIR FILTER DESIGN 9

Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques

UNIT IV FINITE WORD LENGTH EFFECTS 9

Representation of numbers – ADC Quantization noise-Coefficient Quantization error-Product Quantization error-truncation & rounding errors – Limit cycle due to product round-off error-Round-off noise power-limit cycle oscillation due to overflow in digital filters- Principle of scaling.

UNIT V WAVELET AND POWER SPECTRUM ESTIMATION (Qualitative approach only) 9

Introduction to wavelets – Time frequency representation – Discrete wavelet transform, Pyramid algorithm – Comparison of Fourier transform and wavelet transform – Power Spectrum Estimation: The Bartlett Method – The Welch Method – Spectral analysis of ECG signal

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Compute the discrete Fourier transform and its filtering methods.
- Design of infinite impulse response filters for various applications
- Realize the structure of finite impulse response filters.
- Explain the various concepts of finite word length.
- Explain the theory of wavelets and power spectrum estimation

TEXT BOOK:

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

REFERENCE BOOKS:

1. Emmanuel C. Ifeachor, & Barrie. W. Jervis, “Digital Signal Processing”, Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, “Digital Signal Processing”, Tata Mc Graw Hill, 2006.

15UBM507	MICROPROCESSOR AND CONTROLLER LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES :

- To introduce programming concepts using instruction sets of processor and microcontroller
- To familiarize the interfacing of peripheral devices with processor and controller

LIST OF EXPERIMENTS:

1 **8-bit Microprocessor**
- Simple arithmetic operations:
- Addition / subtraction / multiplication / division

2 Programming with control instructions:
- Increment / Decrement.
- Ascending / Descending order.
- Maximum / minimum of numbers.
- Rotate instructions.
- Hex / ASCII / BCD code conversions

3 Peripheral Interface Experiments:
- Simple experiments using 8255, 8253, 8259

4 Interface Experiments:
- A/D Interfacing
- D/A Interfacing.
- Traffic light controller.
- Stepper Motor Interfacing.

5 **8-Bit Microcontroller**

Simple arithmetic operations:
- Addition / subtraction / multiplication / division.

6 Parallel port programming with 8051 using port 1 facility:
- Stepper Motor
- 8-bit LED

7 Programming Exercise on
- RAM direct addressing
- Bit addressing

8 Programming practice using simulation tools and Keil C-compiler
- Initialize timer
- Enable Interrupts

9 Study of Microcontrollers with flash memory

TOTAL: 30 Periods

COURSE OUTCOMES:

At the end of the course the students will be able to

- Demonstrate various components of 8085 processor and 8051 microcontroller kits.
- Compile codes for simple arithmetic and branching operations using 8085 instructions.
- Interface 8085 processor with external peripherals
- Compile codes for simple arithmetic and branching operations and interfacing using 8051 Instructions

HARDWARE REQUIREMENT

Sl. No.	Name of the equipment	Quantity required
1.	8085 Microprocessor Trainer with Power supply	8
2.	8051 Micro controller Trainer Kit with power supply	8
3.	8085 Microprocessor Trainer with Interface facility	6
4.	8255 Interface board	4
5.	8253 Interface Board	3
6.	8259 Interface board	4
7.	ADC card	4
8.	DAC card	3
9.	Stepper motor Interface kit for Processor	2
10.	Stepper motor Interface kit for Controller	2
11.	Traffic Light Controller kit	2
12.	8-bit LED board	2
13.	Regulated power supply	1
14.	Multimeter	2
15.	KEIL software	2 license
16.	8051 Microcontroller trainer kit with flash memory	4

15UBM508	SIGNAL PROCESSING TECHNIQUES LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

The student should be made to:

- Implement Linear and Circular Convolution
- Implement FIR and IIR filters
- Demonstrate Finite word length effect

LIST OF EXPERIMENTS:

Simulation using MATLAB or equivalent software

1. MAC operation using various addressing modes
2. Waveform generation: ECG Signal generation
3. Generation of sequences
4. Implementation of difference equations
5. Linear Convolution
6. Circular Convolution
7. DFT
8. FIR filter design
9. IIR filter design
10. Finite wordlength effects
11. Decimation and Interpolation
12. ECG Peak Detection

DSP Processor Experiment

1. Study of DSP processor architecture
2. Linear and Circular convolution

TOTAL : 30 PERIODS

COURSE OUTCOMES

At the end of the course the students will be able to

- Write programs using simulation software.
- Analyze Finite word length effect on DSP systems
- Implement adaptive filters for various applications of DSP

HARDWARE AND SOFTWARE REQUIREMENT

PCs with related accessories - 15 Nos

MATLAB (licensed) or any equivalent software with Image processing tool box

Image processing software tools

15UBM509 DIAGNOSTICS AND THERAPEUTICS LABORATORY

L	T	P	C
0	0	2	1

OBJECTIVES:

- To provide practice on recording and analysis of different Bio potentials
- To demonstrate the function of different Therapeutic equipments

LIST OF EXPERIMENTS:

1. Simulation of ECG – detection of QRS complex and heart rate
2. Study of shortwave and ultrasonic diathermy
3. Study of biotelemetry
4. Measurement of Respiratory parameters using spirometry
5. Study of medical stimulator
6. Study of ESU – cutting and coagulation modes
7. Recording of Audiogram
8. Recording Heart sounds using Phonocardiograph
9. Calculation of parameters like Drip rate, Total volume infused using drug infusion pump
10. Recording of Electromyogram
11. Electrical safety measurements
12. Study of Continuous Positive Airway Pressure (CPAP) Ventilator and Humidifier

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Record and analyze biopotentials such as ECG, EMG.
- Record and analyze vital parameter of organs such as Ear, lungs, heart.
- Operate therapeutic equipment like shortwave , ultrasonic diathermy, medical stimulator, drug infusion pump and CPAP Ventilator &Humidifier

HARDWARE REQUIREMENT:

1. Multi output power supply (+15v, -15v, +30V variable, +5V , 2A)	2 Nos
2. Short wave Diathermy	1 No
3. Ultrasound Diathermy	1 No
4. Single parameter biotelemetry system	1 No
5. Electrical Safety Analyser	1 No
6. Spirometry with associated analysis system	1 No
7. ECG Simulator	1 No
8. Medical stimulator	1 No
9. Surgical diathermy with analyzer	1 No
10. Audiometer	1 No
11. Phonocardiograph	1 No
12. CPAP device	1 No

SEMESTER VI						
S.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	**15UBM601**	**Medical Imaging Equipments**	**3**	**0**	**0**	**3**
2	**15UBM602**	**Medical Image Processing**	**3**	**0**	**0**	**3**
3.	**15UBM603**	**Biomechanics**	**3**	**0**	**0**	**3**
4.		**Professional Elective – III**	**3**	**0**	**0**	**3**
5.		**Professional Elective – IV**	**3**	**0**	**0**	**3**
6.		**Open Elective – I**	**3**	**0**	**0**	**3**
PRACTICAL						
7.	**15UBM607**	**Digital Image Processing Laboratory**	**0**	**0**	**2**	**1**
8.	**15UBM608**	**Technical Project**	**0**	**0**	**6**	**3**
9.	**15UGS531**	**Soft skills and communication Laboratory (Common to MECH, CIVIL, CHEM & BME)**	**0**	**0**	**2**	**1**
		Total	**18**	**0**	**10**	**23**
Total Credits : 23						

15UBM601	MEDICAL IMAGING EQUIPMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

This course gives knowledge of the principle of operation and design of Radiological equipments

UNIT I X – RAYS 9

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-RayTube, the collimator, Bucky Grid, power supply, Digital Radiography- discrete digital detectors,storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – DigitalFluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

UNIT II COMPUTED TOMOGRAPHY 9

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

UNIT III MAGNETIC RESONANCE IMAGING 9

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

UNIT IV NUCLEAR IMAGING 9

Radio Isotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors –gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gammacamera- Principle of operation, collimator, photo multiplier tube, X-Y positioning circuit, pulse heightanalyzer. Principles of SPECT and PET.

UNIT V RADIATION THERAPY AND RADIATION SAFETY 9

Radiation therapy – linear accelerator, Telegamma Machine. SRS –SRT,-Recent Techniques in radiation therapy - 3D CRT – 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 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Explain the properties and production of x – rays.
- Describe the various diagnosis techniques used in the medicine.
- Elaborate the special radiological equipments.
- Explain the applications of radio isotopes.
- Discuss the safety and protection methods in the radiation departments.

TEXT BOOKS:

1. Isaac Bankman, I. N. Bankman , Handbook Of Medical Imaging: Processing and Analysis(Biomedical Engineering),Academic Press,2000
2. Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis , SPIE Press 2000

REFERENCES:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw – Hill, New Delhi, 2003.
2. Dougherty, Geoff (Ed.), “Medical Image Processing - Techniques and Applications “,Springer-Verlag New York, 2011
3. Khin Wee Lai, DyahEkashantiOctorinaDewi “Medical Imaging Technology”, Springer Singapore, 2015
4. Steve Webb, The Physics of Medical Imaging, Adam Hilger, Philadelpia, 1988 .
5. R.Hendee and Russell Ritenour “Medical Imaging Physics”, Fourth Edition William, Wiley-Liss, 2002.

15UBM602	IMAGE PROCESSING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I IMAGE FUNDAMENTALS 9

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

UNIT II IMAGE ENHANCEMENT 9

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

UNIT III IMAGE RESTORATION 9

Image Restoration - degradation model, Unconstrained restoration - Lagrange multiplier and Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and Merging – Segmentation by morphological watersheds – basic concepts – Dam construction – Watershedsegmentation algorithm.

UNIT V IMAGE COMPRESSION 9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Analyze the fundamentals of images.
- Apply the image preprocessing concepts for medical images.
- Analyze the image reconstruction techniques in imaging modalities.
- Identify the classifications and visualization of medical images for numerous modalities.
- Elaborate the image registration and visualization techniques.

TEXTBOOKS:

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

REFERENCES:

1. Kenneth R. Castleman, Digital Image Processing, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing usingMATLAB',Pearson Education, Inc., 2004.

3. D,E. Dudgeon and RM. Mersereau,‘Multidimensional Digital Signal Processing',Prentice HallProfessional Technical Reference, 1990.
4. William K. Pratt, , Digital Image Processing' , John Wiley, New York, 2002
5. Milan Sonka et al, 'IMAGE PROCESSING, ANALYSIS AND MACHINE VISION', Brookes/Cole, VikasPublishing House, 2nd edition, 1999,

15UBM603	BIOMECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamental terms and concepts of human factors.
- To discuss anthropometrics, physiological and biomechanical principles

UNIT I INTRODUCTION 9

Use of statics, kinetics – rigid and non rigid bodies – Forces and motion – Newtons laws – Momentof force – Static equillibrum – Centre of gravity –Stability of equilibrium – Steps in analyzing a biomechanical problem – Graphical methods – Contact forces – resolution of forces

UNIT II MECHANICAL PROPERTIES OF BONES 9

Bone structure & composition mechanical properties of bone, cortical and cancellous bones –Electrical properties of bone, Fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones. Pseudo elasticity, nonlinear stress – strain relationship, viscoelasticity, structure, function and mechanical properties of skin, ligaments and tendons. Head Injury tolerance, rotational injury, spine injury – Accident reconstruction, Analysis of impact, skid analysis – Damage analysis

UNIT III MECHANICS OF THE JOINTS 9

Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, shoulder, spinal column, hip, knee and ankle. Human locomotion, gait analysis and goniometry, Ergonomics, Foot Pressure measurements – Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis

UNIT IV ALVEOLI MECHANICS 9

Alveoli mechanics, interaction of blood and lung, P-V curve of lung, breathing mechanism, airway resistance, physics of lung diseases.

UNIT V MECHANICAL PROPERTIES OF BLOOD VESSELS 9

Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, physics of cardio vascular diseases, prosthetic heart valves and replacement. Fluids – density – pressure – blood pressure and gravity – laminar and turbulent flow.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Familiarize the basics and fundamentals of biomechanics.
- Explain the mechanical properties of the bones.
- Describe the mechanics of Joints.
- Elaborate the alveoli mechanics.
- Examine the mechanical properties of blood vessels

TEXT BOOKS:

1. Frank Bell, “Principles of Mechanics and Biomechanics”, Stanley Thorne (Publishers) Ltd., 1998
2. Donald R. Peterson and Joseph D. Bronzino, “Biomechanics Principles and applications”, CRC press, Taylor & Francis Group, LLC, 2008
3. Duane Knudson, “Fundamentals of Biomechanics”, Second Edition, Springer publication , 2000

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.

15UBM607 **IMAGE PROCESSING TECHNIQUES LABORATORY** **L T P C**
0 0 2 1

OBJECTIVES:

- To practice the basic image processing techniques.
- To understand the functions of transforms.
- To know the effect of quantization.
- 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. Histogram Processing
5. Medical Image Enhancement-Spatial filtering
6. Medical Image Enhancement - Filtering in frequency domain
7. Basic Morphological operations.
8. Basic Thresholding functions
9. DFT analysis of images
10. Transforms (Walsh, Hadamard, DCT, Haar)
11. Image segmentation – Edge detection, line detection and point detection
12. Analysis of images with different color models.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Perform filtering operations in the image
- Use transforms and analyse the characteristics of the image.
- Write program to analyse the texture of the image
- Implement project on simple image processing applications.
- Apply image processing technique to solve real world problems

Equipments for a batch of 30 students (2 students per experiment):

PCs with related accessories – 15
MATLAB (licensed) or any equivalent software with Image processing tool box
Image processing software tools

REFERENCES:

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

15UBM608	TECHNICAL PROJECT	L	T	P	C
		0	0	6	3

OBJECTIVES:

- To engage the student in integrated activities of reading, research, discussion and presentation around a designated subject

This course is introduced to enrich the communication skills of the student and to create awareness on recent development in Electronic and Instrumentation through project development. In this course, Students shall work in groups of 4 each and work on as mall research problem. Students have to carry out the project under the guidance of faculty member using the knowledge of subjects tha the/ she has learned up to 5th semester. The student should submit the report at the end of the semester. The product should be demonstrated at the time of examination.

COURSE OUTCOMES:

After the successful completion of this course the student will be able to

- Communicate the technical information effectively in oral presentation and writing report
- Analyze small technical problems and develop prototype model

15UGS531	SOFT SKILLS AND COMMUNICATION LABORATORY (Common to MECH, CIVIL &BME)	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop a requisite knowledge in soft skills and communication skills
- To enhance the student"s acumen in sharpening the skills to meet the global challenges and industrial needs

UNITI COMMUNICATION SKILL **10**

ListeningtotheConversation-IntroducingOneselfBeforeAudience-GroupDiscussion-Formal Letterwriting - E Mail Etiquettes - PowerPointPresentation.

UNITII PREPARATION FOR INTERVIEWS **10**

Preparation of Resume-Difference between Bio-data and CV-Visiting Company Website-Gathering Information about Company-Mode of Selection-Different types of Selection Methods– Pre-Placement Talk- Attitude Before Interview.

UNITIII INTERVIEW SKILL **10**

Body Language – Types of Interview –Attending Telephonic Interview – Do's and Don'ts during and after the Interview -Expectation of the Interviewer- Mock Interview.

TOTAL:30Periods

COURSEOUTCOMES:

After the successful completion of this course, thestudentwill be able to

- Present ideas and view points in a very flexible manner in order to differentiate and eliminate ambiguity
- Write well-structured andeasilyreadable reports, e-mailsandarticles oncomplextopics in an appropriate style
- Comprehend any spoken language delivered face to face and through different media like telephone and public announcement

SEMESTER VII

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UBM701	Hospital Management	3	0	0	3
2.	15UBM702	Human Assist Devices	3	0	0	3
3.	15UBM703	Neural Networks and Pattern Recognition	3	0	0	3
4.		Professional Elective – V	3	0	0	3
5.		Open Elective – II	3	0	0	3
PRACTICAL						
6.	15UBM706	Hospital Training	0	0	2	1
7.	15UBM707	Project Design Laboratory	0	0	2	1
		Total	15	0	4	17
Total Credits : 17						

15UBM701	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic planning and organization of Hospitals
- To explain clinical and administrative services
- To analyze the infection control and safety management in hospitals

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry – Challenges in Hospital Administration – Hospital Planning – Equipment Planning – Functional Planning – Current Issues in Hospital Management

UNIT II ORGANIZATION OF THE HOSPITALS 9

Roles of hospital in healthcare – Outpatient services – In patient services – Intensive care unit – Nursing services – Effective hospital management – Casualty & Emergency Services – Organization and management of Operation theatres

UNIT III HOSPITAL INFORMATION SYSTEMS 9

Management Decisions and Related Information Requirement – Hospital Information System – Clinical Information Systems – Administrative Information Systems – Technical Information Systems – Need for computerization of hospitals

UNIT IV SUPPORTIVE SERVICES IN HOSPITAL 9

Organization of Ancillary Services: Lab Services **–** Department of Physiotherapy & Occupational Therapy, Blood Transfusion Services, Radio diagnosis – Medical Transcription – Medical Records Department – Pharmacy – Food Services – Laundry and linen service – Housekeeping – Volunteer department

UNIT V MEDICAL WASTE MANAGEMENT 9

Types of Waste – Importance of infection control – Hand hygiene – Aseptic techniques – Isolation precautions – Disinfection and sterilization – Clinical laboratory standards to infection control – Disposal of biological waste: Incinerator – Hazardous waste, radioactive waste, liquid waste destruction – landfill – Risk management in hospitals

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Outline the administration processes in hospitals.
- Summarize the hospital organization.
- Familiarize the information system used in the hospitals.
- Explain the various supportive services in hospitals.
- Analyze the importance of sterilization and safety.

TEXTBOOKS:

1. Kunders G D, “Biomechanics: Hospitals, facilities planning and management”, Tata McGraw Hill, 2008.
2. Sakharkar B M, “Principles of hospital administration and planning”, Jaypee Brothers Medical Publishers Pvt Limited, 2nd edition, 2009.

REFERENCES:

1. Sanjiv Singh, Sakthikumar Gupta, Sunil Kant, “Hospital infection control guidelines, principles and practice”, Jaypee Brothers Medical Publishers Pvt Limited, First edition, 2012.
2. R.C.Goyal, “Hospital Administration and Human Resource Management”, PHI – Fourth Edition, 2006

15UBM702	HUMAN ASSIST DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made to:

- Explain various mechanical techniques to rescue failing heart.
- Introduce various assist device in hospital practice and explain their useage

UNIT I CARDIAC ASSIST DEVICES 9

Heart/Lung System – Different types of Oxygenators and Pumps – Pulsatile and Continuous Type – Monitoring Process – Shunting – Blood Handling System – Types and Functions of different types of Heart Intra-Aortic Balloon Pumping (IABP) - Venous Arterial Pumping – Prosthetic Cardio Valves

UNIT II ARTIFICIAL KIDNEY 9

Indication and Principles of Haemodialysis – Membrane – Dialysate – Types of Haemodialyzers – Monitoring Systems – Wearable Artificial Kidney – Implanting types

UNIT III RESPIRATORY AND HEARING AIDS 9

Intermittent Positive Pressure, Breathing Apparatus operating sequence – Electronic IPPB Unit with monitors for all respiratory parameters - CPAP machine –Types of Deafness – Hearing Aids, Construction and Functional Characteristics - Audiogram

UNIT IV PROSTHETIC AND ORTHOTIC DEVICES 9

Hand and Arm replacement – Different types of models: Externally powered limb prosthesis - Feedback in Orthotic system - Functional Electrical Stimulation – Sensory assist devices: Vision, dentures – Materials for Prosthetic and Orthotic Devices – Haptic Devices: Tactile, types and applications

UNIT V MEDICAL ROBOTICS 9

Introduction and Overview – History and Clinical Applications - Components and Configurations of Robots – Case Study: Robotic arm – Sensors – Associated accessories for Robotic arm – Flexion and Extension

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Elaborate the assist devices in the cardiac system.
- Differentiate the different types of artificial kidney.
- Explain the different devices used for respiration and hearing assistance.
- Describe the various Prosthetic and Orthotic devices
- Apply the basics of robotics in medical and research areas

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
2. Kolff W.J, “Artificial Organs”, John Wiley and sons, New York, 1976
3. Albert M.Cook and Webster J.G, “Therapeutic Medical Devices”, Prentice Hall Inc., New Jersey, 1982

REFERENCES:

1. D.S. Sunder, “Rehabilitation Medicine”, 3rd Edition, Jaypee Medical Publication, 2010
2. James Moore, George Zouridakis, “Biomedical Technology and Devices Handbook”, CRC Press 2004

15UBM703 NEURAL NETWORKS AND PATTERN RECOGNITION L T P C
3 0 0 3

OBJECTIVES:

- To introduce different neural models to solve regression, classification, feature selection and density estimation problems.
- To explain the learning and adaptation of supervised and unsupervised modes in learning.

UNIT I PATTERN CLASSIFIER 9

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION 9

Clustering for unsupervised learning and classification – Clustering concept – C-means algorithm – Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

UNIT III FEATURE EXTRACTION AND SELECTION 9

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection

UNIT IV NEURAL NETWORKS 9

Fundamentals of Neural Networks – History – Architectures – Learning methods – XOR problem – Delta rule – derivation – Back propagation – parameters in BPN – Associative memory – Hetero associative – BAM – energy function – problems – Associative memories – ART1 – ART2 – Applications

UNIT V FUZZY LOGIC 9

Fuzzy set theory – crisp sets – fuzzy sets – crisp relations – Fuzzy relations – Fuzzy systems – Crisp logic – predicate logic – fuzzy logic – fuzzy based systems – Defuzzification methods – applications

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students will be able to

- Describe the structural pattern classifier
- Interpret the clustering for unsupervised learning and its classification
- Describe the feature extraction and selection techniques
- Explain the basics of neural networks
- Explain the basics of fuzzy logic

TEXT BOOKS:

1. Hagan, Demuth and Beale, “Neural network design”, Vikas PublishingHouse Pvt. Ltd., New Delhi , 2002
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.

3. Timothy J.Ross, ’’Fuzzy Logic with Engineering applications”, John Wiley and Sons, 2010.

REFERENCES :

1. Robert Schalkoff, “ Pattern recognition, Statistical, Structural and neural approaches” John Wiley and Sons(Asia) Pte. Ltd., Singapore, 2005
2. Laurene Fausett ,” Fundamentals of neural networks –Architectures, algorithms and applications”, Prentice Hall, 1994
3. Duda R.O, Hart P.G, “Pattern classification and scene analysis”, Wiley Edition,2000
4. Rajasekaran.S and VijayalakshmiPai.G.A, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2011.

15UBM707	PROJECT DESIGN LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To give training to design various Instrumentation circuits used for physiological parameter acquisition

List of Experiments (Design and Develop any two Experiments with One Hardware)

1. Design and development of Instrumentation for acquiring ECG, EMG
2. Design and development of Instrumentation for acquiring cardiovascular parameters
3. Design and development of Instrumentation for acquiring pulse.
4. Selection of Isolation circuit for biomedical application and study of its characteristics
5. Simulation and Design of ECG amplifier, recording and analysis.
6. Acquisition of Biopotentials.
7. Biomedical Vision Tools to Aid Medical Research and Healthcare
8. Signal analysis using signal database (Physionet Data bases)

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student will be able to

- Choose appropriate sensor for measuring vital physiological parameters
- Design and develop signal processing circuits for ECG, EMG, Pulse
- Collect and analyze date from open biomedical signal database

SEMESTER VIII

S.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	15UME801	Professional Ethics (Common to ALL)	2	0	0	2
2.		Professional Elective – VI	3	0	0	3
3.		Open Elective – III	3	0	0	3
PRACTICAL						
4.	15UBM804	Project work	0	0	24	12
		Total	8	0	24	20
Total Credits : 20						

15UME801	PROFESSIONAL ETHICS (Common to ALL)	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To impart knowledge on value-based approach and provide a method of thinking about and dealing with ethical issues in the work place
- To explain what a profession is and what it means to act professionally

UNIT I ENGINEERING ETHICS 9

Senses of Engineering ethics-Variety of moral issues-Types of inquiry-Moral dilemmas-Moral Autonomy-Kohlberg's theory-gilligan's theory-Consensus and Controversy-Professions and Professionalism-Professional Ideals and Virtues-Uses of Ethical Theories.

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 10

Engineering as Experimentation-Engineers as responsible Experimenters-Research Ethics-Codes of ethics-Industrial standards-A Balanced outlook on Law-The Challenger.

UNIT III GLOBAL ISSUES 11

Multinational Corporations-Business Ethics-Environmental Ethics-Computer Ethics-Role in Technological Development-Engineers as Managers-Consulting Engineers-Honesty-Moral Leadership-Sample code of Conduct.

TOTAL: 30 Periods

COURSE OUTCOMES:

After the successful completion of this course the students will be able to:

- Explain the concept of ethics in engineering profession
- Discuss the code of ethics and industrial standards
- Discuss about globalization and cross cultural issues

TEXT BOOKS:

1. Subramanian.R, "Professional Ethics", Oxford University Press India, NewDelhi,First edition,2013.
2. Dhinesh Babu.S, "Professional Ethics and Human Values", Laxmi Publications, New Delhi,Reprint,2016.

REFERENCES:

1. Jayakumar.V, "Professional Ethics in Engineering", Lakshmi Publications, Chennai.
2. John R Boatright, "Ethics and the conduct of Business" ,Pearson Education,2003.
3. Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press,2001.
4. David Ermann, Michele S Shauf, "Computers, Ethics and Society", Oxford University Press.2003.

LIST OF ELECTIVES

Course Code	Course Title	L	T	P	C
15UBM901	BioMEMS and Nano Electronics	3	0	0	3
15UBM902	Clinical Engineering	3	0	0	3
15UBM903	Intellectual Property Rights	3	0	0	3
15UBM904	Forensic Science	3	0	0	3
15UBM905	Drug Delivery Systems	3	0	0	3
15UBM906	Nuclear Medicine	3	0	0	3
15UBM907	Medical Radiation Safety Engineering	3	0	0	3
15UBM908	Biomaterials	3	0	0	3
15UBM909	Medical Optics	3	0	0	3
15UBM910	Bio Statistics	3	0	0	3
15UBM911	Communication Engineering	2	0	2	3
15UBM912	Biometric Systems	3	0	0	3
15UBM913	Medical Informatics	3	0	0	3
15UBM914	Telemedicine	3	0	0	3
15UBM915	Rehabilitation Engineering	3	0	0	3
15UBM916	Virtual Instrumentation for Biomedical Engineers	2	0	2	3
15UBM917	Embedded Systems in Medicine	3	0	0	3
15UBM918	Brain Computer Interface	3	0	0	3
15UBM919	Neuroscience	3	0	0	3
15UBM920	Cancer Biology	3	0	0	3
15UBM921	Robotics and Automation in medicine	3	0	0	3
15UBM922	Bio-Dynamics	3	0	0	3
15UBM923	Orthopedic mechanics	3	0	0	3
15UBM924	Physiological Modeling	2	0	2	3

15UBM901	BioMEMS and Nano Electronics	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce various MEMS fabrication techniques.
- To impart knowledge on different types of sensors and actuators and their principles of operation at the micro scale level.
- To discuss the applications of MEMS in different fields of medicine

UNIT I MEMS MATERIALS AND FABRICATION 9

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

UNIT II SENSORS AND ACTUATORS 9

Mechanics for MEMs design- static bending of thin plates, mechanical vibration, thermo mechanics, fracture and thin film mechanics. Mechanical sensors and actuators – beam and cantilever – microplates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor

UNIT III THE PROSPECT OF NANOMEDICINE 9

Current Medical Practice, The Evolution of Scientific Medicine – Volitional Normative Model of Disease – Treatment Methodology – Evolution of Bedside Practice – The Nanomedical Perspective, Nanomedicine and Molecular Nanotechnology – Pathways to Molecular Manufacturing- Molecular Transport and Sortation

UNIT IV NANOSENSORS & NANOSCALE SCANNING 9

Nanosensor Technology – Chemical and Molecular Nanosensor – Displacement and Motion Sensors – Force Nanosensor – Thermal Nanosensor – Electric and Magnetic Sensing – Cellular Bio scanning – Macrosensing – intergated nanosensor technologies, genomics & proteomics – real time & in vivo medical monitoring

UNIT V NANODEVICES FOR MEDICINE & SURGERY 9

Nanodevices for Clinical Nanodiagnostics, Nanoendoscopy, Nanobiotechnology and Drug Delivery Devices- Tools for Nanosurgery, Nanoscale Laser Surgery,Nanorobotics for Surgery – Nanotechnology for Detection of Cancer, QDs, Dendrimers for Sensing Cancer Cell Apoptosis, Gold Nanoparticles for Cancer Diagnosis, Nanotubes for Detection of Cancer Proteins, Nanoparticles for the Optical Imaging of Tumours.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Comprehend and appreciate the significance and role of this course in the present contemporary world.
- Discuss various MEMS fabrication techniques.
- Elaborate the basics and prospects of nanomedicine.
- Discuss the Nanosensors & Nanoscale Scanning.

- Describe the nanodevices used in medical field for surgery.

TEXT BOOKS:

1. Chang Liu,‟ Foundations of MEMS‟, Pearson Education International, New Jersey, USA, 2nd Edition, 2011.
2. Robert .A. Freital.Jr, “ Nanomedicine “ Landes Bioscience Press 2010

REFERENCES:

1. Wanjun Wang, Stephen A.Soper,‖BioMEMs: Technologies and applications‖, CRC Press, New York, 2007
2. Marc J. Madou , "Fundamentals of microfabrication: the science of miniaturization‟, CRC Press, 2002
3. Robert A. Freitas, “Nanomedicine, Volume IIA: Biocompatibility”, Landes Bioscience, 2011.
4. Jain.K.K, “Handbook of Nanomedicine” Springer, 2012.

15UBM902	CLINICAL ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the role of clinical engineering in health care and hospitals
- To introduce practices followed in the department of clinical engineering

UNIT I INTRODUCTION 9

Clinical engineering: Definition, Evolution, Role, Responsibilities, Functional status, History of clinical engineering, Enhancing patient safety

UNIT II MEDICAL TECHNOLOGY MANAGEMENT PRACTICES 9

Strategic Medical Technology Planning, Scope , Clinical necessity operational support, strategic planning process – Technology assessment: Technology audit, Budget strategies, Prerequist for medical technology assessment – Device evaluation, Risk reduction, Asset management, ESHTA

UNIT III ESSENTIAL HEALTH CARE TECHNOLOGY PACKAGE (EHTP) 9

Introduction – Health care technology management – Package development: Methodology, Logical framework, Implementation, Information promotion and dissemination – EHTP Justification – EHTP matrix – EHTP advantages – Impact Analysis

UNIT IV CLINICAL ENGINEERING PROGRAM INDICATOR 9

Clinical engineering: program services, Program database – Clinical Engineering Program management, Program indicator, Managing clinical engineering performance using program indicators – Indicator management process

UNIT V PATIENT SAFETY 9

Factors Contributing to Medical Errors: Heath Care Reimbursement, Health Care Failure Mode and Effect Analysis (HFMEA), Patient Safety Best Practices Model: Bar coding, Computerized Physician Order Entry (CPOE), and Clinical data repositories – Process analysis, Methodology

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Explain the significance and role of clinical engineering in the present contemporary world
- Discuss the various medical technology management practices
- Explain types of Health care technology management
- Analyze the concept of clinical program indicator
- List the factors contributing to medical errors and the best practices

TEXT BOOKS:

1. Ernesto Iadanza, Joseph Dyro, “Clinical Engineering Handbook”, Elsevier Academic Press, 2014
2. Robert Miniati, “Clinical Engineering from Devices to Systems”, Academic Press, 23-Dec-2015 - Technology & Engineering

REFERENCES:

1. Jacobson B and Webster J G Medical and Clinical Engineering – Prentice Hall of India New Delhi 1999
2. Cesar A. Cacere & Albert Zana, The Practice of Clinical Engg. Academic press, New York, 1977.
3. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentice Hall Inc., Engle wood Cliffs, New Jersy, 1979.

15UBM903	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To discuss the role of intellectual property rights.
- To practice the patents and copyrights procedures.

UNIT I INTRODUCTION **9**

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

UNIT II PATENTS AND COPYRIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application

UNIT III INTERNATIONAL CONVENTION 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT) – TRIPS Agreement.

UNIT IV STRATEGIES AND POLICIES 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDY 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Explain the basics of intellectual property rights.
- Differentiate the patents and copy rights.
- Discuss the international conventions and agreement on trade and tariff.
- Elaborate the strategies and policies in IPR.
- Explain the different cases in business and trade marks.

TEXT BOOKS:

1. Subbaram N.R. “Handbook of Indian Patent Law and Practice “, S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.
2. PrabuddghaGanguli, “Intellectual Property Rights”, TMH Publishing Co. Ltd., 2001

REFERENCES:

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

15UBM904	FORENSIC SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basic principles of forensic science, crime and criminal justice system, police organization, the role of investigator and tools and techniques used in crime science
- To deal with the modus operandi and role of modus operandi bureau in crime investigation

UNIT I FORENSIC SCIENCE 9

Introduction – Definition – Principles – Laws of Forensic Science – Historical Background of Forensic Science in India - Need of Forensic Science in present scenario – Forensic Science Laboratories – their types and Divisions – Forensic Examination – Organizational set up of Forensic Science Laboratories at central and state level

UNIT II CRIME AND POLICE ORGANIZATION 9

Definition – types of crime – causes of crime, prevention of crime – Difference in blue and white collar crime – Introduction of Cyber crime – Criminal Justice System – Organizational set up of Police at central and state level, Functions of Police – Functions of Police in analyzing a crime scene – Different paramilitary forces in India

UNIT III CRIME SCENE 9

Introduction, Significance-Role of Investigator-Evaluation of crime scene – protection of crime scene – Photography of Crime scene – Tools and techniques – Significance of Photography and Videography- Introduction of Sketching – Purpose of Sketching – Making of Sketches.

UNIT IV FORENSIC EVIDENCES AND ANALYSIS 9

Hair analysis – Fiber analysis – Ballistics & Tool marks: Soil, Glass and Paint – Footprints and tyre impressions – Bite Marks – Finger prints – Blood Spatter Analysis – DNA analysis – Forensic Anthropology and Entomology

UNIT V MODUS OPERANDI & ROLE OF MODUS OPERANDI BUREAU IN CRIME INVESTIGATION 9

Investigation & examination procedure of various types of cases – Murder – Burglary – Railway & Air Crashes – Road Accidents etc.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Define the basic principles of forensic science.
- Analyze the crime, causes and prevention.
- Analyze the role of investigator in sketching and examination of crime scene.
- Analyze the forensic evidences in crime scene.
- Investigate and examine the modus operandi and role of modus operandi bureau in crime investigation

TEXT BOOKS:

1. Saferstein, Richard. "*Criminalistics—An Introduction to Forensic Science"*, 11th ed. Prentice Hall, Saddle River, NJ. 2011
2. Mehta, M. K. : "Identification of Thumb Impression & Cross Examination of Finger Prints", 1980 N. M. Tripathi (P) Ltd. Bombay.
3. Forensic Science: An Introduction 2nd Edition. (Person Education, Inc. 2011)

REFERENCES :

1. Bevel, T., Gardner, M. R., "Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction", Third Edition.
2. Bevel, T., Gardner, M. R., "Practical Crime Scene Analysis and Reconstruction"
3. Lee, C. H., Palmbach, T., Miller, T. M., Henry "Lee's Crime Scene Handbook"
4. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.

15UBM905	DRUG DELIVERY SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce various drug delivery systems and their usage in hospitals

UNIT I CONTROLLED DRUG DELIVERY 9

Fundamentals of Controlled Release (CR) Drug Delivery – Rationale of sustained/controlled drug delivery – Physicochemical and biological factors influencing design and performance of CR products – therapeutic status of CDDS. Theory of mass transfer – Fick's first and second laws and their applications in drug release and permeation. Pharmacokinetic – pharmacodynamic basis of controlled drug delivery – bioavailibility assessment of CR systems.

UNIT II DESIGN AND FABRICATION OF TECHNOLOGY BASED CR SYSTEMS 9

Strategies and design of oral controlled release delivery systems – oral systems based on dissolution, diffusion and dissolution – Ion exchange resins, Ph – independent formulations – altered density formulations – Bucco/mucoadhesive systems. Osmotic controlled oral drug delivery

UNIT III PARENTERAL SYSTEM 9

Parenteral systems, biopharmaceutic considerations-design and development- polymeric microspheres – dispersed drug delivery – Implantable therapeutic systems - Biocompatibility of polymers and carriers – Intrauterine devices and intravaginal devices.

UNIT IV TRANSDERMAL DRUG DELIVERY SYSTEM 9

Transdermal therapeutic systems (TTS): Drug absorption through skin-permeation enhancers, basic components of TTS – Approaches to development and kinetic evaluation – Testing of transdermal patches – pressure sensitive adhesives – Iontophoresis – Sonophoresis and electroporation.

UNIT V TARGETED DRUG DELIVERY 9

History – concept, Types and key elements – ideal carrier system and approach with special reference to organ targeting (e.g. brain, tumor, lung, liver and lymphatics) – Basics of temperature – pH and magnetically induced targeting tactics.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Describe the basic concept of controlled drug delivery system.
- Design and fabricate the technology based Controlled Release System.
- Apply the biopharmaceutical techniques in parenteral system.
- Analyze the transdermal drug delivery system.
- Examine the targeted drug delivery and its key elements for targeting tactics.

TEXT BOOKS:

1. Tozer T N, Rowland M, "Introduction of Pharmacokinetics and Pharmacodynamics: The Quantitative Basis of Drug Therapy", Williams & Wilkins, 2006.

2. Howard C. Ansel, NIcholos G. Popvich, Iyold V. Allen , “Pharmaceutical dosage forms and Drug Delivery system”, 1st edition, 2014.
3. Jain N.K and Sharma S.N. “A text book of professional pharmacy”, 1st edition 1995.

REFERENCES :

1. Samuel Harder and GlennV. Buskirk. “Pilot Plant Scale-Up Techniques. In The Theory and Practice of Industrial Pharmacy”. 3rd edition., 1991
2. Remington, “The Science and Practice of pharmacy”, 20 th Edn, vol.I, pg.no.903- 913.
3. Lachman et al “Theory and Practice of Industrial Pharmacy”. 3rd edition Philadelphia, 1991,
4. S.D. Bruck, “Controlled Drug Delivery”, Vol.1 (Basic Concepts) CRC Press. Florida, 1983

15UBM906	NUCLEAR MEDICINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basics of nuclear medicine
- To discuss the construction and principle of operation of various nuclear medicine instruments and their application in health care

UNIT I BASICS OF NUCLEAR MEDICINE 9

Radioactivity and interaction of radiation; Alpha, Beta and gamma emission - Laws of radioactive decay - Mechanisms of radioactive delay - Radiation intensity and exposure - Decay schemes and energy levels - Compton scattering - Pair productions - Particle interactions

UNIT II RADIOPHARMACEUTICALS 9

Radio nuclide production - 99Mo/99mTc generator - Mechanism of localization - Types of radiopharmaceuticals - characteristics of radio pharmaceuticals - Radiopharmaceuticals for diagnosis and treatments in human - Dispensing of radio pharmaceuticals

UNIT III NUCLEAR MEDICINE INSTRUMENTATION 9

Construction and principle operation of Gamma camera - Rectilinear scanner - Basic principles of pulse height analyser - Radiation detectors - Ionization chamber - Geiger Muller counter- Semiconductor detectors-Scintillation detectors - Electronic Instrumentation for radiation detection system

UNIT IV DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF RADIONUCLIDE 9

PET-CT-Single photon emission computed tomography (SPECT) - Radio iodine therapy for Thyrotoxicosis -Differentiated thyroid cancers- Palliative treatment for bone metastasis - 32P and 89 Strontium Dosage-Intravascular particulate radio nuclide Therapy-Receptor targeted therapy-131I MIBG Therapy-Targeted internal radiation in HCC: 90 Y, Radio - synovectomy using Yttrium

UNIT V RADIATION SAFETY 9

Radiation protection indifferent nuclear isotope therapy procedures - Management of radiation accidents - Radiation effect on pregnancy and fertility-Diagnosis, evaluation and treatment of radiation overexposure-Instruments used in radiation survey & monitoring - Handling of radioactive patients - Role of national and international bodies in radiation safety - ICRP recommendations - BARC regulations regarding limits of radiation exposure

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the basics of nuclear radiation and its interactions.
- Elaborate the types of radiopharmaceuticals.
- Describe the principle and working of nuclear medicine instruments.
- Realize the medical applications in radio nuclide.
- Apply the radiation safety measurements.

TEXT BOOKS:

1. Simon Cherry, James Sorenson, Michael Phelps. “Physics in Nuclear Medicine”, Elsevier Saunders , 4th Edition, 2012.
2. Jennifer Prekeges, “Nuclear Medicine Instrumentation”, Jones and Barlett publishers, 1st edition, 2011.

REFERENCES:

1. Max. H. Lombardi, “Radiation safety in Nuclear Medicine”, CRC Press, Florida, USA, 2nd edition 1999.
2. Gopal B.Saha “Physics and Radiobiology of Nuclear Medicine” Springer, 3rd ed, 2006

15UBM907	MEDICAL RADIATION SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide an insight to the basics of radiation physics.
- To enable them to understand the guidelines of radiation protection and radiation detectors.
- To provide information on safety measures related to UV, laser and nuclear medicine

UNIT I INTRODUCTION TO RF AND MICROWAVE RADIATION 9

Sources of radio frequency radiation – Effects of radio frequency radiation – Development of standards for human safety – Calculation of RF field quantities – RF radiation measuring instruments and methods.

UNIT II RADIATION DETECTION AND MEASUREMENT 9

Fundamentals of radiation detection – Conducting radiation measurements and surveys – Gas detectors – Designing to reduce radiation hazards – Radio frequency radiation safety management and training – Scintillation detectors – Statistics of counting – minimum detectable activity – Quality assurance of radiation counters

UNIT III RADIATION SAFETY IN NUCLEAR MEDICINE AND RADIOTHERAPY 9

Design and description of NM department – Radiation protection in nuclear industry – Guidelines for radiation protection – Molecular medicine and radiation safety program procedures for safe operation of radiation equipment – Radiation protection in external beam radiotherapy – Radiation protection in brachytherapy – Radioactive wastes.

UNIT IV LASER AND ULTRAVIOLET RADIATION SAFETY 9

Classification of UV radiation-Sources of UV – Biological effects of UV – Hazards associated with UV radiation – UV control measures-Safety management of UV – Classifications of LASER and its radiation hazards – control measures – Emergencies and incident procedures.

UNIT V MONITORING AND INTERNAL DOSIMETRY 9

Monitoring methods-personal radiation monitoring-Records of personal dosimetry – ICRP method – MIRD method – Internal doses from radiopharmaceuticals – Bioassay of radioactivity – Hazard and risk in radiation protection – radiological incidents and emergencies – Regulation to radiation protection.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Discuss the sources of RF and microwave radiation.
- Explain about the radio detection and protection.
- Elaborate the radio safety in nuclear medicine and radiotherapy.
- Describe the classification of laser and ultraviolet radiation safety.
- Analyze the monitoring methods and internal dosimetry.

TEXT BOOKS:

1. JamieV,Trapp, Thomas Kron, “An introduction toradiation protection inmedicine”, CRC press Taylor &Francis group, 2008
2. Alan Martin, Samuel Harbison, Karen Beach, Peter Cole, Hodder Arnold, “An introduction to radiation protection”, 6th edition 2012

.

REFERENCES:

1. Max Hlombardi,“Radiation safety in nuclear medicine”,CRC Press Taylor &Francis group, 2nd edition ,2007
2. ArunaKaushik, Anupam mondal,DwarakanathB.S, Tripathi RP “Radiation protection manual”, INMAS, DRDO, 2010.
3. Ronald kitchen,“RF and microwave radiation safety”,Newness publishers,2ndedition, 2001.

15UBM908	BIOMATERIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the characteristics and classification of biomaterials
- To discuss the response of biomaterials in living system and their replacement
- To impart knowledge on compatibility and functioning of artificial organs inside the living system

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

Definition and classification of bio-materials, mechanical properties, visco elasticity, wound-healing process, body response to implants, Testing of biomaterials: In-vitro, in-vivo preclinical tests, blood compatibility, HLA compatibility

UNIT II IMPLANT MATERIALS 9

Different classes of materials used in medicine - Mechanical & Thermal properties Metallic implant materials, stainless steels, co-based alloys, Ti-based alloys, ceramic implant materials, aluminum oxides, hydroxyapatite, glass ceramics, carbons, medical applications

UNIT III POLYMERIC IMPLANT MATERIALS 9

Polymerization, polyamides, Acryrilic polymers, rubbers, high strength, thermoplastics, medical applications. Bio polymers: collagen and elastin. 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 9

Small intestinal submucosa and other decellularized matrix biomaterials for tissue repair. Soft-tissue replacements, types of transplant by stem cell, sutures, surgical tapes, adhesive, Percutaneous and skin implants, maxillofacial augmentation, Vascular grafts, hard tissue replacement Implants, joint replacements, Pancreas replacement.

UNIT V ARTIFICIAL ORGANS 9

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

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Comprehend and appreciate the significance and role of biomaterials, testing and compatibility.
- Discuss the various implant materials.
- Explain the different types of polymeric implant materials.
- Describe the various tissue replacement implants.
- Elaborate the different artificial organs.

TEXT BOOKS:

1. Sujata V. Bhatt, Biomaterials 7th edition, Narosa Publishing House, 2005.
2. Joon B.Park Joseph D. Bronzino, Biomaterials - Principles and Applications – CRC press, 2003

REFERENCES:

1. Ratner A, and S.Hoffman, B. D. “Biomaterials Science: An Introduction to Materials in Medicine”, Academic Press; 3 edition,November 8, 2012
2. Joon Bu Park, Roderic S, Lakes, “Biomaterials”, Springer-Verlag, New York Inc., 2010
3. Myer Kutz, ―Standard Handbook of Biomedical Engineering & Design‖, McGraw-Hill, 2003
4. John Enderle, Joseph D. Bronzino, Susan M.Blanchard, ―Introduction to Biomedical Engineering‖ Elsevier, 2005.
5. AC Anand, J F Kennedy, M.Miraftab, S.Rajendran, ―Medical Textiles and Biomaterials for Healthcare‖, Woodhead Publishing Limited 2006.

15UBM909	MEDICAL OPTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the optical properties of the tissues
- To discuss the applications of laser in diagnosis and therapy.

UNIT I OPTICAL PROPERTIES OF THE TISSUES 9

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

UNIT II INSTRUMENTATION IN PHOTONICS 9

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

UNIT III SURGICAL APPLICATIONS OF LASERS 9

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

UNIT IV NON THERMAL DIAGNOSTIC APPLICATIONS 9

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

UNIT V THERAPEUTIC APPLICATIONS 9

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Differentiate the optical properties of tissues
- Describe the concepts of instrumentation in photonics.
- Explain the surgical applications of laser.
- Describe the photonics in non thermal diagnostic applications.
- Apply the principles of laser mechanism in therapeutics applications.

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

REFERENCES:

1. Robert Splinter, Brett A. Hooper, ‘An Introduction to Biomedical Optics’, Taylor & Francis, 2008.
2. Pedrotti, ‘Introduction to Optics’, Pearson Education India, 2008
3. Abraham Katzir, ‘Lasers and Optical Fibers in Medicine’, Elsevier, 2012.

15UBM910	BIOSTATISTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the techniques used in statistical & regression analysis.
- To compare the various parameters used in statistical significance

UNIT I INTRODUCTION **9**

Biostatistics - Statistical problems in Biomedical research – Basic concepts: Population, Samples and Variables - Basic probability, likelihood & odds, distribution variability.

UNIT II STATISTICAL PARAMETERS **9**

Statistical parameters p-values, computation and level chi square test and distribution

UNIT III REGRESSION ANALYSIS **9**

Regression – Linear regression – Multiple linear regression – Multiple colinearity, Determining Best regression – Non linear regression – Logistic regression – Poison regression

UNIT IV INTERPRETING DATA **9**

Life table: Interpreting life tables clinical trails, epidemical reading and interpreting of epidemical studies, application in community health.

UNIT V META ANALYSIS **9**

META analysis for research activities, purpose and reading of META analysis, Forest graph, Funnel plots, Radial plots, L'Abbe plots, Criticisms of Meta analysis

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Classify common statistical tests and tools.
- Distinguish between p-values and confidence intervals as measures of statistical significance.
- Interpret commonly used regression analysis.
- Explain the data tables and its interpretations in community health.
- Evaluate commonly used statistical and epidemiologic measures.

TEXT BOOKS:

1. Joseph A. Ingelfinger, Frederick Mosteller, Lawrence A. Thibodeau, James H. Ware 'Biostatistics in Clinical Medicine', (third edition), Singapore, 1994.
2. Gerald van Belle, Lloyd D. Fisher, Patrick J. Heagerty, Thomas Lumley, 'Biostatistics: A Methodology For the Health Sciences', John Wiley & Sons, 2004.

REFERENCES:

1. Julien I.E. Hoffman, 'Biostatistics for Medical and Biomedical Practitioners', Elsevier Press, 2015.
2. James F. Jekel, 'Epidemiology, Biostatistics, and Preventive Medicine', Elsevier Health Sciences, 2007.
3. Ray M. Merrill, 'Fundamentals of Epidemiology and Biostatistics, Jones & Bartlett Publishers, 2012.

’15UBM911	COMMUNICATION ENGINEERING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce the fundamentals of analog and digital communication
- To provide the knowledge of various coding techniques for data transmission
- To impart the knowledge of satellite and optical fiber communication

UNIT I ANALOG COMMUNICATION 10

AM – Frequency spectrum–vector representation–power relations – generation of AM – DSB, DSB/SC, SSB,VSB AM Transmitter & Receiver; FM and PM – frequency spectrum – power relations: NBFM & WBFM, Generation of FM and DM, Armstrong method & Reactance modulations :FM & PM frequency.

UNIT II DIGITAL COMMUNICATION 10

Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM, PTM, quantization and coding: DCM, DM, slope overload error. ADM, DPCM, OOK systems – ASK, FSK, PSK, BSK, QPSK, QAM, MSK, GMSK, applications of Data communication

UNIT III SOURCE CODES, LINE CODES & ERROR CONTROL 10

Primary communication – entropy, properties, BSC, BEC, source coding: Shannon – Fano, Huffman coding: noiseless coding theorem, BW–SNR tradeoff, codes: NRZ, RZ, AMI, HDBP, ABQ, MBnB codes: Efficiency of transmissions, error control codes and applications: convolutions & block codes

List of Experiments: 30

1. Generation and Detection of Amplitude Modulation
2. Generation of Frequency Modulation and its Detection
3. Generation and Detection of PAM
4. Generation of BFSK and its Detection
5. Generation of standard inputs using simulation package

Total: 60 Periods

COURSEOUTCOMES:

After the successful completion of this course the students will be able to

- Compare different kind of analog and digital modulation techniques in terms of generation demodulation, power and bandwidth requirement
- Summarize various digital modulation techniques
- Develop different types of error control codes

TEXTBOOKS

1. Tauband Schiling, “Principles of communication systems”,Tata McGrawhill,2007.
2. J. Das, Mullick ,S. K., Chatterjee P.K., “Principles of digital communication”, New Age International,2012.

REFERENCES:

1. Kennedy and Davis, “Electronic communication systems”,TataMcGrawHill,4th Edition, 1993.
2. Sklar, “Digital communication fundamentals and applications”, Pearson Education, 2001.
3. Bary le, Memu schmidt, “Digital Communication”,Kluwer Publication, 2004.
4. Amitabha Bhattacharya, “Digital Communication”, Tata Mc Grawhill, 2006.

15UBM912	BIO METRIC SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To discuss the fundamentals of biometric
- To introduce fingerprint identification technology, face recognition and voice scan technology

UNIT I BIOMETRIC FUNDAMENTALS 9

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

UNIT II FINGERPRINT IDENTIFICATION TECHNOLOGY 9

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

UNIT III IRIS RECOGNITION 9

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

UNIT IV FACE RECOGNITION 9

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

UNIT V VOICE SCAN 9

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

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the basic concept of biometric system.
- Identify the fingerprint using algorithms.
- Describe the anatomical recognition of iris.
- Discuss the recognition of face using algorithms.
- Elaborate the features and methods of voice scan.

TEXT BOOKS:

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

REFERENCES:

1. John D. Woodword Jr., “Biometrics”, Dreamtech Press, New Delhi, 2003.
2. John R. Vacca, ‘Biometric Technologies and Verification Systems’, Elsevier, 2007.
3. Ted Dunstone, Neil Yager, ‘Biometric System and Data Analysis: Design, Evaluation, and Data Mining, Springer Science & Business Media, 2008.

15UBM913	MEDICAL INFORMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce ICT applications in medicine with an introduction to health informatics.
- To discuss the theories and practices adopted in Hospital Information Systems in the light of medical standards, medical data formats and recent trends in Hospital Information Systems

UNIT I MEDICAL INFORMATICS 9

Introduction – Health Informatics – Structure of Medical Informatics – Internet and Medicine – Security issues – Functional capabilities of a computerized Healthcare Information Systems – e-health services – Prospects of Medical Informaticians

UNIT II COMPUTERISED PATIENT RECORD 9

Introduction – History taking by computer – Dialogue with the computer – Components and functionality of Computerized Patient Record – Development tools – Intranet – CPR in Radiology – Legal, Security and Privacy Issues – Application server provider

UNIT III MEDICAL DATA AND STANDARDS 9

Medical data storage and retrieval techniques – Steganography – Medical Standards: Health Level 7 – DICOM – IEEE 1073 – IRMA – LOINC – ICD10 – Medical standard organizations

UNIT IV COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9

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

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual reality applications in medicine – Computer assisted surgery – Surgical simulation – Telemedicine – Tele surgery computer aids for the handicapped – Computer assisted instrumentation in Medical Informatics

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the overview of medical informatics
- Describe the various computerized patient record
- Differentiate the different medical standards
- Explain the computers in clinical laboratory and medical imaging
- Discuss the recent trends in medical informatics

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.

15UBM914	TELEMEDICINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the key principles for telemedicine and healthcare application.
- To introduce telemedical standards, mobile telemedicine and it applications

UNIT I TELEMEDICINE AND HEALTH 9

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 9

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

UNIT III TELEMEDICAL STANDARDS 9

Data Security and Standards: Encryption – DES, RSA, Mechanisms and Phases of Encryption – Cryptography – Protocols: TCP/IP, ISO-OSI, Standards: DICOM, HL7, H. 320 series (Video phone based ISBN) T.120, H.324 (Video phone based PSTN)

UNIT IV TELEMEDICAL APPLICATIONS 9

Introduction to Robotics surgery – Tele radiology – Basic parts of a Teleradiography System, Image acquisition and display system, Communication and Interpretation – Tele pathology, Telesurgery, Telecardiology, Teleoncology, Telemedicine in neurosciences, Telepsychiatry, Teledermatology, Telehome – Care Home based Applications

UNIT V ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE 9

Confidentiality, Patient rights and consent, Ethical and legal aspects of internet – Administration of centralized medical data, Security, Confidentially of medical records and access control, Cyber laws related to telemedicine – Telemedical malpractice – Consent treatment, Jurisdictional issues, Intellectual Property Rights – Constraints linked to economy, social acceptance

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Describe the overview of telemedicine and health
- Differentiate the various technologies used in telemedical field
- Discuss the different medical standards
- Explain the telemedical applications
- Elaborate the ethical and legal aspects of telemedicine

TEXT BOOKS:

1. Olga Ferrer-Roca, Marcelo Sosa-Iudicissa, “Handbook of Telemedicine”, IOS press, 2003
2. A. C. Norris, “Essentials of Telemedicine and Telecare”, John Wiley & Sons 2002.

REFERENCES:

1. Ling Guan, “Multimedia image and video processing”, CRC Press 2000
2. Thorsten M Buzug, Heinz Handels, Dietrich Holz, “Telemedicine: Medicine and Communication”, Springer Verlag 2001
3. Douglas V.Goldstein, “E Healthcare: Harness the power of Internet, e-commerce and e-care”, Jones and Barlett Publishers
4. Bemmel, J.H. van, Musen, M.A. (Eds.) “Handbook of Medical Informatics”, Heidelberg, Germany: Springer, 1997
5. Mohan Bansal, “Medical Informatics”, Tata McGraw-Hill, 2004

15UBM915	REHABILITATION ENGINEERING	L	T	P	C
		3	0	0	3

Objectives:

Student should be made to:

- To discuss the need of rehabilitation
- To introduce Therapeutic Exercise Techniques and rehabilitation in Orthopedic, Prosthetics and Orthotics in rehabilitation

UNIT I INTRODUCTION TO REHABILITATION 9

Rehabilitation Concepts - Engineering Concepts in Sensory Rehabilitation, Motor Rehabilitation - Rehabilitation Engineering Technologies: The Conceptual Frameworks - The Provision Process - Education and Quality Assurance – Specific Impairments and Relates Technologies - Future Developments - Design Considerations - Total Quality Management in Rehabilitation Engineering

UNIT II PROSTHETIC AND ORTHOTIC DEVICES 9

Fundamentals – Amputation - Lower extremity prosthetics - Upper limb prosthetics (transradial), (transhumeral) - Ankle foot orthoses (AFO) - Knee Ankle Foot Orthoses (KAFO) - Truncal and Cervical orthoses – Assistive Devices – Adaptive Devices - Applications

UNIT III WHEELED MOBILITY: WHEELCHAIRS AND PERSONAL TRANSPORTATION 9

Introduction - Categories of Wheelchairs - Wheelchair Prescriptions - Wheelchair Structure and Component Design - Ergonomics of Wheelchair Propulsion - Power Wheelchair Electrical Systems - Personal Transportation - Wheelchair Safety, Standards And Testing

UNIT IV MEDICAL STIMULATOR 9

Neural Prostheses for Movement Restoration: Introduction - Movement Actuators of Skeletal Muscles - Functional Electrical Stimulation (FES) Principles - Instrumentation for FES - Neural Prostheses for Restoring Upper and Lower Extremity Functions

UNIT V THERAPEUTIC EXERCISE TECHNIQUE 9

Co-ordination exercises - Frenkels exercises - Gait analyses : Pathological Gaits - Gait Training - Relaxation exercises - Methods for training Relaxation - Strengthening exercises - Strength training - Types of Contraction - Mobilization exercises - Endurance exercises

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Discuss the concepts of rehabilitation.
- Analyze the prosthetic and orthotic devices.
- List the various types of personal transportation.
- Differentiate the types of medical stimulators.
- Explain the various therapeutic exercise techniques.

TEXT BOOKS:

1. Rory A Cooper, “Rehabilitation Engineering Applied To Mobility And Manipulation”, IOP Publishing Ltd 1995.

2. James Moore, George Zouridakis, “Biomedical Technology and Devices Handbook”, CRC Press 2004.

REFERENCES:

1. Dr. S. Sunder, Rehabilitation Medicine-, 3 Edition, Jaypee Medical Publications, New Delhi. 2010.
2. Joseph D. Bronzino, The Biomedical Engineering Handbook, Third Edition: Three Volume Set, CRC Press, 2006.
3. Susan B O’Sullivan, Thomas J Schmitz, Physical Rehabilitation. 5th Edition, Davis publications, 2007.

15UBM916	VIRTUAL INSTRUMENTATION FOR BIOMEDICAL ENGINEERS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To introduce virtual instrumentation concepts and applications.
- To train to program virtual instrumentation software for biomedical applications

UNIT I INTRODUCTION **10**

Programming paradigms – Virtual Instrumentation – Definition to Virtual Instrumentation (VI) – LabVIEW software – LabVIEWbasics – LabVIEW environment.

UNIT II VI USING LABVIEW **10**

Creating, Editing and debugging a VI in LabVIEW – Creating a sub VI – Loops and charts – Case and sequence structures – File I/O – VI customization.

UNIT III DATA ACQUISITION AND CONTROL IN VI **10**

Plug-in DAQ boards – Organization of the DAQ VI System – Performing analog input and analog output – Scanning multiple analog channels – Driving the digital I/Os – Buffered data acquisition – Simple problems

List of Experiments **30**

1. Creating Virtual Instrumentation for simple applications
2. Programming exercises for loops and charts
3. Programming exercises for clusters and graphs.
4. Programming exercises on case and sequence structures, file Input / Output.
5. Data acquisition through Virtual Instrumentation.
6. Developing voltmeter using DAQ cards.

TOTAL : 60 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Identify salient traits of a virtual instrument and incorporate these traits in projects.
- Apply different components of VI in simple applications
- Experiment, analyze and document in the laboratory prototype measurement systems using a computer, plug-in DAQ interfaces and bench level instruments.
- Apply the advanced virtual instrumentation technologies using simulation software for medical application

TEXT BOOKS:

1. Jerome, Jovitha, “Virtual Instrumentation and LABVIEW”, PHI Learning, New Delhi, First Edition, 2010.
2. Sanjay Gupta and Joseph John, “ Virtual Instrumentation using LabVIEW”, Tata Mc Graw – Hill Publishing Company Limited, New Delhi, 1st Edition, 2005.

REFERENCES:

1. Gupta, “Virtual Instrumentation Using Lab View”, Tata McGraw Hill, New Delhi,1st Edition, 2008.

15UBM917	EMBEDDED SYSTEMS IN MEDICINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach the fundamentals, Building Blocks of Embedded System, Embedded processor Modeling, Bus Communication in processors, Input/output interfacing.
- To discuss on aspects required in developing a new embedded processor, different Phases & Modeling of embedded system
- To introduce on processor scheduling algorithms, Basics of Real time operating system
- To study basic concepts of embedded C, Embedded OS

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS 9

Introduction to Embedded Systems – Structural units in Embedded processor, selection of processor & memory devices – DMA, Memory management methods – Memory mapping, cache replacement concept, Timer and Counting devices, different Phases & Modeling of the Embedded product Development Life Cycle (EDLC)

UNIT II EMBEDDED SYSTEM DESIGN FUNCTIONALITIES 9

Timers, watch dog timers, RAM, flash memory, basic toolset, integration of hardware & firmware, Application programming, IDE, target configuration, Host based debugging analyser, Remote debugging, ROM emulators, logic.

UNIT III EMBEDDED PROGRAMMING 9

C and Assembly – Programming Style – Adding Structure to 'C' Code: Object oriented programming with C, Header files for Project and Port, Examples. Meeting Real-time constraints: Creating hardware delays - Need for timeout mechanism – Creating loop timeouts – Creating hardware timeouts.

UNIT IV EMBEDDED NETWORKING AND INTERRUPTS SERVICE MECHANISM 9

Embedded Networking: Introduction, I/O Device Ports & Buses– Serial Bus communication protocols - RS232 standard – RS485 – USB – Inter Integrated Circuits (I^2C) – interrupt sources , Programmed-I/O busy-wait approach without interrupt service mechanism – ISR concept-– multiple interrupts – context and periods for context switching, interrupt latency and deadline - Introduction to Basic Concept Device Drivers.

UNIT V EMBEDDED SYSTEMS IN MEDICAL DEVICES 9

Design consideration of patient monitoring systems, Circuit implementation, Interfacing of oximeter sensors with microcontroller, Software coding and implementation, System description of pacemaker, Interfacing of pacemaker elements with processor, Software coding of pacemaker and implementation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Analyze various Phases & Modeling of the Embedded product Development Life Cycle (EDLC).
- List out various embedded system design functionalities.
- Write the C code to develop embedded software.

- Design real time embedded systems using the concepts of I^2C.
- Design a Medical Device using Embedded System.

TEXT BOOKS:

1. James K. Peckol, “Embedded system Design”, John Wiley & Sons, 1st edition, 2010.
2. Steve Oualline, ‘Practical C Programming 3rd Edition’, O’Reilly Media, Inc, 2006.

REFERENCES:

1. Shibu.K.V, “Introduction to Embedded Systems”, TataMcgraw Hill,2009
2. Elicia White, “Making Embedded Systems”, O’Reilly Series, SPD, 1st edition, 2011.
3. G. Baura, "A Biosystems Approach to Industrial Patient Monitoring and Diagnostic Devices”, Morgan& Claypool, IEEE, 2008.
4. Michael J Pont, “Embedded C”, Pearson Education, 2007.

15UBM918	BRAIN COMPUTER INTERFACE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION TO BCI 9

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

UNIT II ELECTROPHYSIOLOGICAL SOURCES 9

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

UNIT III FEATURE EXTRACTION METHODS 9

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

UNIT IV FEATURE TRANSLATION METHODS 9

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

UNIT V APPLICATIONS OF BCI 9

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

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Evaluate user interfaces and detect usability problems by doing usability studies (observations) with human subjects.
- Assign functions appropriately to human and machine.
- Develop high-fidelity prototypes using at least one development tool.
- Analyze the various methods of feature translation using vector machine.
- Discuss the applications of brain computer interface in medical field.

TEXT BOOKS:

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

REFERENCES:

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

15UBM919	NEURO SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To review the anatomy and physiology of nervous system
- To discuss the neurological disorders and behavior science

UNIT I INTRODUCTION TO NERVOUS SYSTEM 9

Central and peripheral nervous system – Signaling molecules: First growth factor, First Neuro transmitters in brain – Cell biology and synapse – functional organization, Synaptic potentials and Receptor potentials

UNIT II NEURO ANATOMY 9

Structures and functions of neurons – Synapse – function, signals produced by neurons – Sensors function – Glial cells – molecular and cellular organization of neuronal differentiation – characterization of neuronal cells.

UNIT III NEUROPHYSIOLOGY AND NEUROPHARMACOLOGY 9

Pharmaceutical mediator released by neurons – Hormones and their effect on neuronal function – Conduction of impulses by neurons – Correlation of sensory functions

UNIT IV NEUROLOGICAL DISORDERS 9

Pathogenesis – Genetic basis of neurological disorders – Psychiatric Disorders: Psychiatric epidemiology, Unipolar depression, Bipolar depression, Seasonal affective disorder, Panic disorder, Autism, Stroke, Huntington disease

UNIT V BEHAVIOUR SCIENCE 9

Neuronal mechanism of behavior – Animal behavior – Behaviour in various environments.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the anatomy and physiology of nervous system.
- Analyse the neural transmission procedures
- Discuss the various neurological disorders and their symptoms.
- Elaborate the neuronal and animal behavior science in various environments.

TEXT BOOKS:

1. A.B. Schiebel, “Neurobiology of higher cognitive function”, Guilford Press 1990.
2. Michael J. Aminoff, “Handbook of Clinical Neurology”, Elsevier, London, 2012

REFERENCES:

1. Beadle, Progress in Neuropharmacology and Neurotoxicology of pesticides and drugs, 1999.
2. Daniel Gardner, “Neurobiology of Neural Networks”, A Bradford Book, MIT press, Cambridge, London, 1993
3. A.R. Damasio, “Neurobiology of Decision Making”, Springer, Heidelberg, 1996
4. Haynes, “Neuron in Tissue Culture”, 1998.

15UBM920	CANCER BIOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To import knowledge on Cancer Biology fundamentals and principles of carcinogenesis.
- To discuss molecular cancer cell biology and metastasis
- To introduce various therapeutic procedures

UNIT I FUNDAMENTALS OF CANCER BIOLOGY 9

Regulation of cell cycle – Mutations that cause changes in signal molecules – Effects on receptor- signal switches – Tumor suppressor genes – Modulation of cell cycle in cancer – Different forms of cancers – Cancer screening and early detection – Prediction of aggressiveness of cancer – Detection using biochemical assays – tumor markers – Molecular tools for early diagnosis

UNIT II PRINCIPLES OF CARCINOGENESIS 9

Theory of carcinogenesis – Chemical carcinogenesis – Metabolism of carcinogenesis, principles of physical carcinogenesis – x-ray radiation – mechanisms of radiation carcinogenesis – Diet and cancer

UNIT III PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9

Signal targets and cancer – Activation of kinases – Oncogenes – identification of oncogenes, retroviruses and oncogenes, detection of oncogenes, Oncogenes/proto oncogene activity, Growth factors related to transformation, Telomerases.

UNIT IV PRINCIPLES OF CANCER METASTASIS 9

Clinical significances of invasion – Heterogeneity of metastatic phenotype – metastatic cascade, basement membrane disruption – three step theory of invasion – Proteinases and tumour cell invasion.

UNIT V NEW MOLECULES FOR CANCER THERAPY 9

Different forms of therapy – Chemotherapy – Radiation therapy – Detection of cancers –– Use of signal targets towards therapy of cancer – Gene therapy – Advancement in cancer therapy, Nano systems for drug delivery.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the basics of tumor marker and mutation in cell cycle that causes cancer.
- Analyze the principles of Carcinogens.
- Analyze the concepts of molecular cell biology of cancer.
- Explain the principles of cancer metastasis.
- Discuss the various treatment procedure currently available for cancer.

TEXT BOOKS:

1. Roger John Benjamin King,, “Cancer Biology”, Pearson/Prentice Hall, 2006
2. Dunmock N.J And Primrose S.B., “Introduction to Modern Virology”, Blackwell Scientific Publications, Oxford, 1988.

REFERENCES:

1. Raymond W Ruddon, “Cancer Biology”, Oxford University Press, 4E, 2007.
2. Momna Hejmadi, “Introduction to Cancer Biology”, Ventus publishing, 2010
3. Robert A. Weinberg, “Introduction to Cancer Biology”, Garland Science, 2E, 2014

15UBM921	ROBOTICS AND AUTOMATION IN MEDICINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explain the basic concepts of robots and types of robots
- To discuss the designing procedure of manipulators, actuators and grippers and applications of robot in the medical field
- To impart knowledge on various types of sensors and power sources

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, Pediatri and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Describe the configuration and applications of robots..
- Explain the concept of grippers and actuators.
- Explain the functions of manipulators and basic kinematics.
- Choose and implement various power sources and sensors for robotic surgery

TEXT BOOKS:

1. Nagrath and Mittal, “Robotics and Control”, Tata McGrawHill, 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, “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:System Applications & Visions”, Springer 2011.

15UBM922	BIO DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To review human anatomy and physiology of motion
- To elaborate human body dynamics , musculoskeletal system dynamics
- To explain various internal forces of human body and energy transfers
- To discuss the basics of three dimensional motion

UNIT I INTRODUCTION TO HUMAN BODY STRUCTURE AND MOTION 9

Human Body Structure: Skeletal Tree, Bone, Cartilage, and Ligaments, Joints of the Human Body, Physical Properties of Skeletal Muscle, Muscle Groups and Movement, Particles in Motion: Conservation of Linear Momentum, Center of Mass and Its Motion, Multiplication of Vectors, Moment of a Force, Moment of Momentum about a Stationary Point, Moment of Momentum about the Center of Mass

UNIT II BODIES IN PLANAR MOTION AND STATICS 9

Planar Motion of a Slender Rod, Angular Velocity, Angular Acceleration, Angular Momentum , Conservation of Angular Momentum, Applications to Human Body Dynamics, Instantaneous Center of Rotation Equations of Static Equilibrium, Contact Forces in Static Equilibrium, Structural Stability and Redundancy , Structures and Internal Forces, Distributed Forces

UNIT III INTERNAL FORCES AND THE HUMAN BODY 9

Complexity of the Musculoskeletal System, Muscle Force in Motion, Examples from Weight Lifting, Arm and Joint Angle, Multiple Muscle Involvement in Flexion of the Elbow, Biarticular Muscles, Physical Stress, Musculoskeletal Tissues, Limb-Lengthening.

UNIT IV IMPULSE, MOMENTUM AND ENERGY TRANSFERS 9

Principle of Impulse and Momentum, Angular Impulse and Angular Momentum, Elasticity of Collision: Coefficient of Restitution, Initial Motion Kinetic Energy, Potential Energy, Conservation of Mechanical Energy, Multibody Systems, Applications to Human Body Dynamics

UNIT V THREE-DIMENSIONAL MOTION 9

Time Derivatives of Vectors, Angular Velocity and Angular Acceleration, Conservation of Angular Momentum, Dancing Holding on to a Pole, Rolling of an Abdominal Wheel on a Horizontal Plane, Biomechanics of Twisting Somersaults, Throwing and Hitting Motions

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Examine the anatomical movement patterns in the human body.
- Analyze the physical laws that govern how the human body moves.
- Identify the characteristics of human tissues important for locomotion.
- Differentiate the impulse, momentum and energy transfer.
- Evaluate movement and estimate force on human structures during exercise and sports.

TEXT BOOKS:

1. Roger Bartlett, “Introduction to Sports Biomechanics: Analysing Human Movement Patterns”, Second Edition, Taylor & Francis, 2007.
2. Knudson Duane, “Fundamental of Biomechanics”, Second Edition, Springer, 2007.
3. Aydın Tözeren, “Human Body Dynamics: Classical Mechanics and Human Movement”, Springer-Verlag, New York, Inc. 2000.

REFERENCES :

1. David A. Winter, “Biomechanics and Motor Control of Human Movement”, John Wiley & Sons; 4th Edition, 2009.
2. Joseph Hamill, “Biomechanical Basis of Human Movement”, Lippincott Williams and Wilkins, 1995.

15UBM923	ORTHOPEDIC MECHANICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students to understand issues in the field of Orthopaedic Biomechanics
- To introduce the current state of knee, dental, spinal, and other orthopaedic implants.
- To discuss the treatments available for fracture healing

UNIT I THE MUSCULOSKELETAL SYSTEM 9

Anatomical Overview – The functions of the Musculoskeletal System: Bones – Soft Tissue Structures – Loads and Motion in the Musculoskeletal System, Basic Concepts: Static Analysis of Skeletal System, The Musculoskeletal Dynamics Problem

UNIT II MECHANICS OF BONE, INJURY AND REPAIR 9

Introduction, Composition of Bone, Bone as a Hierarchical Composite Material, Elastic Anisotropy, Material Properties of Cortical Bone, Activities: The Knee, The Hip, The Spine, The Shoulder, Injury and Repair

UNIT III BASIC ORTHOPAEDIC SKILLS 9

Splints and Tractions, Plaster. Slabs and Casts, Manipulative reduction of common fractures and dislocations, Infiltration of tender periarticular lesions, Aseptic technique of joint fluid aspiration

UNIT IV TRAUMATOLOGY 9

Fracture, definition, types, signs and symptoms and management. Subluxation/ dislocations – definition, signs and symptoms, management

UNIT V PROSTHESIS 9

above knee prosthesis, below knee prosthesis, component materials, prosthesis, orthosis, , hip prosthesis design, EMG analysis, signal processing

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Explain the musculoskeletal system static and dynamic analysis.
- Elaborate the mechanics of bones, injury and repair.
- Explain the basic orthopedic skills.
- Classify the types of trauma and the basics of signs, symptoms and its management.
- Describe the different types of prosthesis.

TEXT BOOKS:

1. Dhanjoo N. Ghista, Robert Roaf, Orthopaedic Mechanics: Procedures and Devices, Academic Press, 2014.
2. Beth A. Winkelstein, “Orthopaedic Biomechanics”, CRC Press, 2012

REFERENCES:

1. Mark E Baratz, “Orthopaedic Surgery The Essentials”, Thieme , New York , 1999.
2. Manoj Ramachandran, “Basic Orthopaedic Sciences: The Stanmore Guide”, CRC Press 2006
3. Douglas S.Rigg. Control Theory and Physiological Feedback Mechanism, The Wilkliam and Wilkins Co. Baltimore, 1970

15UBM924	PHYSIOLOGICAL MODELING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To develop skills to model vital organs and to simulate their physiology
- To discuss the steps to develop dynamic models and simulate their response

UNIT I SYSTEM CONCEPT **10**

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 with electrical analog, Simplified model of respiratiory system , Simulation of aortic segments ,Comparison of muscle and model isotonic response, Step response of resistance / compliant systems – Dye dilution study of circulation, pulse response of first order system.

UNIT II TRANSFER FUNCTION **10**

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

UNIT III PERIODIC SIGNALS **10**

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 mode 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.

List of Simulation Experiments **30**

1. Linear Modeling and simulation of cardiovascular vessel physiology
2. Linear Modeling and simulation of Heart
3. Linear Modeling and simulation of airway mechanics
4. Linear Modeling and simulation of circulatory system
5. Linear Modeling and simulation of heart rate variability
6. Linear Modeling and simulation of gas diffusion process

TOTAL : 60 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Classify and discuss various Physiological components
- Derive transfer functions of cardiovascular and respiratory system
- Classify various periodical signals generated by physiological
- simulate and visualize dynamic responses by implementing simple physiological models using software

TEXT BOOKS:

1. Willian B.Blesser ,ASystem Approach to Biomedicine , McGraw Hill Book Co., New York, 1969.
2. Manfreo Clynes and John H.Milsum, Biomedical Engineering System , McGraw Hill and Co.,New York , 1970.

REFERENCES:

1. Micheal C.K.Khoo ,"Physiological Control System Analysis ,Simulation and Estimation ".- Prentice Hall of India , New Delhi , 2001.
2. Richard Skalak and Shu Chien , Hand Book of Biomedical Engineering , McGraw Hill and Co.New York, 1987.
3. Douglas S.Rigg. Control Theory and Physiological Feedback Mechanism, The Wilkliam and Wilkins Co. Baltimore, 1970

LIST OF OPEN ELECTIVES

S. No	Course Code	Course Title	L	T	P	C
1	15UBM951	Biomedical Instrumentation Systems	3	0	0	3
2	15UBM952	Computer Applications in Medicine	3	0	0	3
3	15UBM953	Forensic Science in Health Care	3	0	0	3
4	15UBM954	Nuclear Medicine	3	0	0	3

15UBM951	BIOMEDICAL INSTRUMENTATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the electrical and non-electrical physiological measurements.
- To familiarize with functions of the bioamplifiers.

UNIT I BIO POTENTIAL ELECTRODES 9

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

UNIT II ELECTRODE CONFIGURATIONS 9

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

UNIT III BIO AMPLIFIER 9

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 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers- systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurement.

UNIT V BIO-CHEMICAL MEASUREMENT 9

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors - Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Explain the types of biopotential electrodes.
- Describe the electrode configurations of ECG, EEG and EMG.
- Discuss the functions of bio amplifiers.
- Elaborate the measurement of non electrical parameters.
- Familiarize the bio chemical measurements.

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

15UBM952 COMPUTERS APPLICATIONS IN MEDICINE L T P C
3 0 0 3

OBJECTIVES:

- To teach PC hardware and its related interfacing
- To understand the basics of computerized data acquisition
- To study the concepts of Computer Assisted Instruction and computers in patient education

UNIT I PC HARDWARE AND OVERVIEW 9

System Unit – Overview of Mother Boards – Processors, Memory, Adapter cards, Ports, Power supply – BIOS – DOS interaction, POST, Functional and Architecture Block diagram of a PC, Mother Board logics – Memory and I/O map

UNIT II PERIPHERAL INTERFACING AND CONTROLLERS 9

Keyboard and Mouse Interfaces – Memory types: RAM, SDRAM and RDRAM, Cache memory, ROM, Flash memory – Adapter Cards – Sound Card, Modem card, Video card, Network Card – I/O slots: ISA, PCI and AGP bus slots – Ports: Serial and Parallel ports, USB, FireWire port, MIDI, SCSI, IRDA, Bluetooth Connectors – System Bus: ISA, EISA, PCI, AGP and PCI bus – Disk controllers

UNIT III DATA ACQUISITION AND MEDICAL INFORMATION RETRIEVAL 9

Plug-in-data acquisition and Control Boards – Data acquisition using GPIB and Serial Interfaces – Medical Information Retrieval – MEDLARS – Unified Medical Language System(UMLS) – Semantics Net – Finding useful information from the Internet

UNIT IV COMPUTER ASSISTED INSTRUCTION (CAI) IN MEDICINE 9

Computer Assisted Instruction – Learning Process – Preclinical CAI – Visible Human Project – Active Learning Centre – Clinical Simulations – Virtual Patient Project – Problems with CAI – Interactive Multimedia Education in Medicine – Computer as an Evaluator – Computer Based Testing (CBT)

UNIT V COMPUTER ASSISTED PATIENT EDUCATION 9

Computer Prescription – Need for computerized prescription – Health online – Electronic Communication with Patients – Patient Self Management Education – Computers in the care of critically ill patients – Clinical notes – Clinical Information System

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Describe the overview of PC hardware.
- Explain the various peripheral interfaces and controllers.
- Elaborate the data acquisition and medical information retrieval.
- Explain the computer assisted instruction in medicine.
- Discuss the computer assisted patient education.

TEXT BOOKS:

1. Ramachandra Lele, “Computers in Medicine Progress in Medical Informatics”, Tata McGraw Hill Publishing Company, New Delhi, 2005

2. N.Mathivanan, “PC Based Instrumentation: Concepts and Practice”, Prentice Hall of India, New Delhi 2007

REFERENCES:

1. B.Govindarajalu, “IBM PC and Clones: Hardware, Trouble shooting and Maintenance”, Tata McGraw Hill Publishing Company, New Delhi, 2005
2. Mohan Bansal, “Medicl informatics”, Tata McGraw Hill Publishing computers Ltd, 2003 New Delhi

15UBM953	FORENSIC SCIENCE IN HEALTH CARE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about the basic principles of forensic science
- To study about crime and criminal justice system
- To study about the police organization
- To study about the role of investigator and tools and techniques used in crime science
- To deal with the modus operandi and role of modus operandi bureau in crime investigation

UNIT I FORENSIC SCIENCE 9

Introduction – Definition – Principles – Laws of Forensic Science – Historical Background of Forensic Science in India - Need of Forensic Science in present scenario – Forensic Science Laboratories – their types and Divisions – Forensic Examination – Organizational set up of Forensic Science Laboratories at central and state level

UNIT II CRIME 9

Definition – types of crime – causes of crime, prevention of crime – Difference in blue and white collar crime – Introduction of Cyber crime – Criminal Justice System – Criminal behavior

UNIT III POLICE ORGANIZATION 9

Organizational set up of Police at central and state level, Functions of Police – Relationship of Police and Forensic Scientist – History of different paramilitary forces

UNIT IV CRIME SCENE 9

Introduction, Significance-Role of Investigator-Evaluation of crime scene – protection of crime scene – Photography of Crime scene – Tools and techniques – Significance of Photography and Videography- Introduction of Sketching – Purpose of Sketching – Making of Sketches.

UNIT V MODUS OPERANDI & ROLE OF MODUS OPERANDI BUREAU IN CRIME INVESTIGATION 9

Investigation & examination of various types of cases – Murder – Burglary – Railway & Air Crashes – Road Accidents etc.

TOTAL : 45 PERIODS

COURSEOUTCOMES:

At the end of the course, the student should be able to:

- Explain the basic principles of forensic science.
- Elaborate the crime and its causes and prevention.
- Discuss the police organization and its state level.
- Analyze the role of investigator and what is sketching and its purpose.
- Interpret the modu operandi and role of modus operandi bureau in crime investigation

TEXT BOOKS:

1. Saferstein, Richard. "*Criminalistics—An Introduction to Forensic Science"*, 11th ed. Prentice Hall, Saddle River, NJ. 2011
2. Mehta, M. K. : "Identification of Thumb Impression & Cross Examination of Finger Prints", 1980 N. M. Tripathi (P) Ltd. Bombay.
3. Forensic Science: An Introduction 2nd Edition. (Person Education, Inc. 2011)

REFERENCES:

1. Bevel, T., Gardner, M. R., “Bloodstain Pattern Analysis with an Introduction to Crime Scene Reconstruction”, Third Edition.
2. Bevel, T., Gardner, M. R., “Practical Crime Scene Analysis and Reconstruction”
3. Lee, C. H., Palmbach, T., Miller, T. M., Henry “Lee's Crime Scene Handbook”
4. Moenssens : Finger Prints Techniques, 1975, Chitton Book Co., Philadelphia, New York.

15UBM954	NUCLEAR MEDICINE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of nuclear medicine
- To study the construction and principle of operation of various nuclear medicine instruments.
- To have some knowledge about the characteristics and mechanisms of radiopharmaceuticals
- To study the diagnostics and therapeutic applications of nuclear medicine.

UNIT I BASICS OF NUCLEAR MEDICINE 9

Radioactivity and interaction of radiation; Alpha, Beta and gamma emission - Laws of radioactive decay - Mechanisms of radioactive delay - Radiation intensity and exposure - Decay schemes and energy levels - Compton scattering - Pair productions - Particle interactions

UNIT II RADIOPHARMACEUTICALS 9

Radio nuclide production - 99Mo/99mTc generator - Mechanism of localization - Types of radiopharmaceuticals - characteristics of radio pharmaceuticals - Radiopharmaceuticals for diagnosis and treatments in human - Dispensing of radio pharmaceuticals

UNIT III NUCLEAR MEDICINE INSTRUMENTATION 9

Construction and principle operation of Gamma camera - Rectilinear scanner - Basic principles of pulse height analyser - Radiation detectors - Ionization chamber - Geiger Muller counter- Semiconductor detectors-Scintillation detectors - Electronic Instrumentation for radiation detection system

UNIT IV DIAGNOSTIC AND THERAPEUTIC APPLICATIONS OF RADIONUCLIDE 9

PET-CT-Single photon emission computed tomography (SPECT) - Radio iodine therapy for Thyrotoxicosis -Differentiated thyroid cancers- Palliative treatment for bone metastasis - 32P and 89 Strontium Dosage-Intravascular particulate radio nuclide Therapy-Receptor targeted therapy-131I MIBG Therapy-Targeted internal radiation in HCC: 90 Y, Radio - synovectomy using Yttrium

UNIT V RADIATION SAFETY 9

Radiation protection indifferent nuclear isotope therapy procedures - Management of radiation accidents - Radiation effect on pregnancy and fertility-Diagnosis, evaluation and treatment of radiation overexposure-Instruments used in radiation survey & monitoring - Handling of radioactive patients - Role of national and international bodies in radiation safety - ICRP recommendations - BARC regulations regarding limits of radiation exposure

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Explain the basics of nuclear radiation and its interactions.
- Elaborate the types of radiopharmaceuticals.
- Describe the principle and working of nuclear medicine instruments.
- Realize the medical applications in radio nuclide.
- Apply the radiation safety measurements

TEXT BOOKS:

1. Simon Cherry, James Sorenson, Michael Phelps. “Physics in Nuclear Medicine”, Elsevier Saunders , 4th Edition, 2012.
2. Jennifer Prekeges, “Nuclear Medicine Instrumentation”, Jones and Barlett publishers, 1st edition, 2011.

REFERENCES

1. Max. H. Lombardi, “Radiation safety in Nuclear Medicine”, CRC Press, Florida, USA, 2nd edition 1999.
2. Gopal B.Saha “Physics and Radiobiology of Nuclear Medicine” Springer, 3rd ed, 2006

LIST OF INTER DISICIPLINARY COURSES

S. No	Course Code	Course Title	L	T	P	C
1	15UGM951	Electrical Hazards and Safety In Hospitals	3	0	0	3
2	15UGM952	Biofluid Mechanics	3	0	0	3
3	15UGM953	Big Data and IOT in Medical Applications	3	0	0	3

15UGM951 ELECTRICAL HAZARDS AND SAFETY IN HOSPITALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge in the theory and characteristics of fluid mechanics.
- To study the characteristics of flow.
- To familiarize the concepts of cardiovascular physiology.
- To understand the biomechanics of the human circulation.

UNIT I REVIEW OF BIOPOTENTIAL AND RECORDING 9

Electrodes as bioelectric transducers: The electrode-electrolyte interface; Specification and selection criteria for electrodes; Surface, needle, implanted electrodes; Polarisable and non-polarisable electrodes; Practical considerations for optimum performance; Reduction of interference, grounding, safety

UNIT II ELECTRICAL STIMULATION AND ITS PARAMETERS 9

Use in generating evoked potentials – therapeutic correction (ECT, pacemakers, defibrillation), Safety limits and precautions; Safety: Hazards associated with the use of electrical /electronic instruments; Provisions for safety; Clinical safety norms.

UNIT III RADIATION HAZARDS & SAFETY 9

Retorted Potentials and concepts of radiation, Radiation from a small current element. Radiation resistance: Introduction to Electromagnetic Interference and Electromagnetic compatibility, EMI coupling modes, Methods of eliminating interference, shielding, grounding, conducted EMI, EMI testing: emission testing, susceptibility testing.

UNIT IV HOSPITAL SAFETY 9

Security & Safety of Hospital - Property, Staff & Patients, Safety precautions, Factors Contributing to Medical Errors: Health Care Reimbursement, Health Care Failure Mode and Effect Analysis (HFMEA).

UNIT V ELECTRICAL & FIRE SAFETY 9

Sources of shocks, macro & micro shocks - Hazards, monitoring and interrupting the operation from leakage current – Elements of fire, causes of fire, Action to be taken in case of fire in a Hospital

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Review the different types of biopotentials electrodes.
- Discuss the various electrical stimulation parameters.
- Analyze the hazards of radiations and the safety measures.
- Apply the safety measures and precautions made in hospitals.
- Explain the electrical and fire safety.

TEXT BOOKS:

1. M.J. Aminoff , Electrodiagnosis in Clinical Neurology, 3rd edition, Churchill Livingstone, USA, 1992.

2. J.A. Delisa, H.J. Lee, E.M. Baran, K.S. Lai & N. Spielholz , Manual of Nerve Conduction and Clinical Electrophysiology, 3rd Edition, Academic Press, New York, 1993.
3. Joseph F Dyro “Clinical Engineering Handbook”, Elsevier Publishers, 2004.

REFERENCES:

1. Sharon Myers “Patient Safety & Hospital Accreditation - A Model for Ensuring Success”, Springer Publishers, 2012.
2. Webster J.G and Albert M.Cook, Clinical Engg, Principles & Practices, Prentic Hall Inc., Engle wood Cliffs, New Jersy, 1979.
3. Cadick, Mary Capelli-Schellpfeffer, and Dennis K. Neitzel ; Electrical Safety Handbook by John 2005 , McGraw-Hill Professional; 3 edition

15UGM952 **BIOFLUID MECHANICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge in the theory and characteristics of fluid mechanics.
- To study the characteristics of flow.
- To familiarize the concepts of cardiovascular physiology.
- To understand the biomechanics of the human circulation.

UNIT I BASICS OF FLUID MECHANICS 9

Units and dimensions – Properties of fluids – mass density, specific weight, specific volume, specific gravity, viscosity, Newton law of viscosity, compressibility, vapour pressure, surface tension and capillarity, Types of fluid, Fluid Pressure.

UNIT II FLOW CHARACTERISTICS AND FLUID DYNAMICS 9

Types of flow: Laminar, Turbulent, steady, unsteady, uniform, non uniform flows, stream line, streak line, path line – continuity equation, Reynolds equation of motion, Navier stokes equation.

UNIT III FLOW THROUGH CIRCULAR CONDUITS 9

Boundary layer – Boundary layer thickness – Viscous flow – Hagen poiseuille equation – Major loss – Darcy Weisbach equation – friction factor – Moody diagram – minor losses.

UNIT IV CARDIOVASCULAR PHYSIOLOGY AND RHEOLOGY OF BLOOD 9

Cardiovascular Physiology: Introduction – Heart – Cardiac Valves – Systemic Circulation – Coronary Circulation – Pulmonary Circulation and Gas Exchange in the Lungs – Cerebral and Renal circulations – Microcirculation, Rheology of blood flow – Regulation of the Circulation – Rheology of Blood – Vascular Mechanics.

UNIT V BIOMECHANICS OF THE HUMAN CIRCULATION 9

Static and Steady Flow Models: Introduction – Hydrostatics in the Circulation – Applications of the Bernoulli Equation – Rigid Tube Flow Models – Estimation of Entrance Length and Its Effect on Flow Development in Arteries – Flow in Collapsible Vessels.

Unsteady Flow and Non uniform Geometric Models: Introduction – Windkessel Models for the Human Circulation – Continuum Models for Pulsatile Flow Dynamics – Hemodynamic Flow through Curved Arteries and Bifurcations.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

After the successful completion of this course, the student will be able to

- Explain the basics of fluid mechanics.
- Analyze the types of flow and fluid dynamics.
- Discuss the flow of fluids through conduits.
- Summarize the cardiovascular physiology and rheology of blood.
- Characterize the steady and unsteady flow of human circulation.

TEXT BOOKS:

1. John F. Douglas, Janusz M. Gasiorek, John A. Swaffield, Lynne B. Jack, “Fluid Mechanics” Pearson/Prentice Hall, 2005
2. David Rubenstein, Wei Yin, Mary D. Frame “Biofluid Mechanics: An Introduction to Fluid Mechanics, Macrocirculation, and Microcirculation”, Academic Press, 2015

REFERENCES:

1. A. K. Mohanty, “Fluid Mechanics”, PHI Learning Pvt. Ltd., 1994
2. Shiv Kumar, “Fluid Mechanics: Basic Concepts & Principles”, Ane Books Pvt Ltd, 2010
3. Krishnan B. Chandran, Stanley E. Rittgers, Ajit P. Yoganathan “Biofluid Mechanics: The Human Circulation,” Second Edition CRC Press, 2012.
4. Mazumdar Jagannath, “Biofluid Mechanics” Second Edition, World Scientific, 2015.

15UGM953 BIG DATA AND IOT IN MEDICAL APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basics of Internet of things(IoT) and protocols
- To explain the concepts of Web of Things and Cloud of Things
- To discuss the healthcare operations and recent development

UNIT I INTRODUCTION TO BIGDATA 9

Introduction to Big Data Platform–Challenges of conventional systems-Web data–Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting- Modern data analytic tools, Statistical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT II DATA ANALYSIS 9

Regression modeling, Multivariate analysis, Bayesian modeling, Inference and Bayesian networks, and Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, and Stochastic search methods.

UNIT III INTRODUCTION TO IoT 9

Introduction to Elements of IoT - Basic Architecture of an IoT Application Sensors & Actuators - Edge Networking (WSN) – Gateways - IoT Communication Model – WPAN & LPWA, Future Trends – Standards

UNIT IV IOT IN HEALTH CARE 9

Role of IoT in Health care – Architecture of Health Care in IoT – Integrated framework for operations management – Evidence Based Medicine and Pay for Performance – Hospital business operations – Devices and Mobile apps for health care – Challenges for MIoT & Big Data in Health care.

UNIT V RECENT DEVELOPMENTS 9

Techniques and tools – Map Reduce paradigm and the Hadoop system – IoT: Clustering, Synchronisation and Software Agents. Applications, Social Media Analytics – IoT in Non Invasive Critical Brain activity monitor, Cardio Diagnostics – Fraud Detection – Big Data in Medicine and Healthcare – Digital companion

TOTAL : 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to:

- Analyze various protocols for IoT and a middleware for IoT.
- Identify the various sources of Big Data, new algorithms for collecting Big Data from various sources.

- Design algorithms for pre-processing Big Data and to extract data from structured and un-structured data for analytics.
- Explain the role of IOT in health care.
- Apply IoT in medicine and health care applications.

TEXT BOOKS:

1. Michael Berthold, David J.Hand, “Intelligent Data Analysis”, Springer, 2007.
2. Anand Rajaraman and, Jeffrey David Ullman, ”Mining of Massive Datasets”, Cambridge University Press, 2012
3. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things: Key Applications and Protocols”, 2nd Edition, Wiley Publications, 2012.

REFERENCES:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj , “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends”, John Wiley & Sons, 2013
2. Dieter Uckelmann ,Mark Harrison , Florian Michahelles, “Architecting the Internet of Things”, Springer Publishing, 2011
3. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014
4. R.Langabeer ” Healthcare Operations Management: A Quantitative Approach to Business and Logistics ”, Jones & Bartlett Publishers, First Edition, 2007