

NOOURL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER I

(Common for All B.E/B.Tech. Programmes Except Marine Engineering)

Sl. No	Course Code	Course Title	L	T	P	C
THEORY						
1.	EG1101	Technical English – I	3	1	0	4
2.	MA1101	Engineering Mathematics – I	3	1	0	4
3.	PH1101	Engineering Physics – I	3	0	0	3
4.	CH1101	Engineering Chemistry - I	3	0	0	3
5.	ME1101	Engineering Graphics	3	0	0	3
6.	CS1101	Fundamentals of Computing and Programming	3	0	0	3
PRACTICAL						
7.	CS1171	Computer Practice Lab - I	0	1	2	2
8.	ME1171	Computer Aided Drafting and Modeling Lab	0	1	2	2
9.	PH1171	Physics Lab – I	0	0	2	1
10.	CH1171	Chemistry Lab - I	0	0	2	1
TOTAL			18	4	8	26

*** Those who have admitted from the Academic Year 2013-2014 onwards**

EG1101

TECHNICAL ENGLISH – I

3 1 0 4

UNIT-I

9

Verb-Tenses -12 Tenses-8 Passive Forms- Word formation with prefixes and suffixes

UNIT-II

9

Expansion of Compound Nouns – Punctuation - Definitions of Technical Terms - Changing words from one form to another - Imperatives and Instructions - Conditional clauses.

UNIT-III

9

Interrogatives and Question Tags - Asking Questions - Comprehension – Discourse Markers

UNIT –IV

9

Concord - Identifying Common Errors - Cause and Effect Expressions – Paragraph Writing – Copy Writing: Slogans and Captions - Writing Instructions - Letter Writing (Formal Letters)

UNIT –V

9

Creative Writing – Transcoding: Bar Chart, Flow Chart - Pie Chart - Tree Diagram - Tabular Column

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

TEXT BOOK:

Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Combined Edition (Volumes 1 @ 2), Chennai: Orient Black Swan Pvt.Ltd.,2006 Themes 1-4 (Resources, Energy, Computer, Transport)

EXTENSIVE READING:

A.P.J.Abdul Kalam with Arun Tiwari, Wings of Fire: An Autobiography, University Press (India) Pvt.Ltd, 1999, 30 Impression 2007

NOTE:

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

MA1101

ENGINEERING MATHEMATICS - I

3 1 0 4

AIM:

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve a well founded knowledge about the principles of Mathematics.

OBJECTIVE:

The course objective is to develop the required skill of the students in the area of

Engineering Mathematics with special emphasis on the characteristic equation of matrices, differential calculus, Beta and Gamma functions and to develop basic knowledge to the students in double and triple integration.

UNIT I MATRICES

9

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of eigen values and eigen vectors(without proof)– Cayley Hamilton theorem (statement only), verification and its applications – Orthogonal and Symmetric matrices and their properties(excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form.

UNIT II DIFFERENTIAL CALCULUS

9

Curvature – Cartesian co-ordinates and parametric form -Centre and radius of curvature, Circle of curvature – Evolutes.

UNIT III FUNCTIONS OF SEVERAL VARIABLES

9

Partial derivatives – Total derivatives – Jacobians – Properties – Maxima and minima for functions of two variables–Lagrange Multiplier method- Taylor’s expansion.

UNIT IV BETA AND GAMMA INTEGRALS

9

Evaluation of improper integrals- Beta and Gamma functions – Properties – Relation between Beta and Gamma functions - Evaluation of integrals using Beta and Gamma functions.

UNIT V MULTIPLE INTEGRALS

9

Evaluation of double and triple integrals – Area as double integral in cartesian and polar co-ordinates– Change of order of integration- Transformation of Cartesian coordinates into polar coordinates.

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

TEXT BOOK:

Grewal B.S., “Higher Engineering Mathematics”- 40th Edition , Khanna Publishers, Delhi 2007.

REFERENCES:

- 1 Veerarajan T, “ Engineering Mathematics (for first year)”, Tata McGraw- Hill Publishing Company Ltd.,New Delhi , 2007
- 2 Erwin Kreyszig, “ Advanced Engineering Mathematics”, 7th Edition, Wiley India, 2007.
- 3 P.Kandasamy , K.Thilagavathy , K.Gunavathy” Engineering Mathematics” Vol,1 S.Chand & Company Ltd.2002
4. B.V. Ramana,”Higher Engineering Mathematics” Tata McGraw- Hill, Publishing Company Ltd.,New Delhi, 2006

AIM:

To provide a sound knowledge on the principles of Physics and its practical applications in various areas of Engineering and Technology.

OBJECTIVE:

At the end of the course students would be exposed to

- The mechanical properties of matter and its engineering applications
- Application of ultrasonics in Industry and Medical field
- The important properties of light and their application
- Application of laser and fiber optics in communication and technology
- The fundamentals of heat- energy conversion and its application.

UNIT I Properties of matter**9**

Elasticity – Poisson's ratio – Stress-strain diagram – factors affecting elasticity – bending of beams – cantilever – bending moment – theory and experiment of Young's modulus determination – Uniform and non-uniform bending – I shaped girders – twisting couple – hollow cylinder – shaft – torsion pendulum – determination of rigidity modulus

UNIT - II Ultrasonics**9**

Introduction-production of ultrasonic waves- magnetostriction effect- magnetostriction generator-piezoelectric effect-piezoelectric generator-detection of ultrasonic waves-properties - velocity measurement - acoustic grating-industrial applications-drilling, welding, soldering and cleaning- SONAR- non destructive testing pulse echo system-medical applications-sonograms.

UNIT –II Optics**9**

Interference: air wedge- theory and experiment-testing of flat surfaces- Michelson's Interferometer-types of fringes- applications (determination of wavelength and thickness of thin transparent medium).

Polarization: Introduction- double refraction, quarter and half wave plates- production of plane, circularly and elliptically polarized light-detection of plane, circularly & elliptically polarized light.

Photoelasticity- Stress-optic law- photoelastic bench

UNIT- IV Lasers & Fiber Optics**9**

Introduction- principle of spontaneous emission and stimulated emission, Einsteins A and B coefficients-derivation- population inversion, pumping, types of lasers- Nd-YAG, CO₂- applications.

Principle and propagation of light in optical fibre- numerical aperture and acceptance angle- types of optical fibres (material, refractive index, mode)- double crucible technique of fibre drawing, fibre optic communication system (Block diagram)-fibreoptic sensors.

UNIT – V Heat and Thermodynamics**9**

Thermal conductivity- Forbe's and Lee's disc methods-radial flow of heat- thermal conductivity of rubber and glass-thermal insulation in buildings - Laws of thermodynamics- Carnot's cycle as heat engine – efficiency, Otto engine & Diesel engine (qualitative).

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. R.K. Gaur and S.L.Gupta, 'Engineering Physics' Dhanpat Rai publications, New Delhi.
2. Marikani A, 'Engineering Physics' PHI learning pvt ltd, III Edition, New Delhi.
3. Palanisamy.P.K., 'Engineering Physics' Scitech publications, Chennai.
4. M.N. Avadhanulu and PG Kshirsagar. ' A Text book of Engineering Physics', S.Chand and company, Ltd., New Delhi.

REFERENCES:

1. Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint.
2. Brijlal and Subrahmanyam 'Heat and Thermodynamics' S. Chand , Limited.
3. Ajoy Ghatak, ' Optics' Tata McGraw Hill Publications, New Delhi.
4. Brijlal and Subrahmanyam 'Properties of Matter' S. Chand , Limited.

CH1101**ENGINEERING CHEMISTRY-I****3 0 0 3****AIM**

To have a thorough knowledge of the basics of chemistry particularly engineering oriented topics to engineering students.

OBJECTIVES

To make the students conversant with the principles of the following topics: (i) Water Technology, (ii) Engineering Materials and Polymers,(iii) Surface Chemistry and Nanomaterials,(iv) Analytical Techniques and (v) Chemical Kinetics

UNIT I**WATER TECHNOLOGY****9**

Water as a universal solvent – hard and soft water – reasons for hardness – disadvantages of hard water in washing and industrial purposes - estimation of hardness by EDTA method, problems; boiler feed water – characteristics- softening methods - external conditioning – demineralization (ion exchange) process, desalination by reverse osmosis method- internal conditioning (phosphate, calgon and carbonate conditioning methods); stages in domestic water treatment – disinfection by chlorination, ozone and UV treatments.

UNIT-II ENGINEERING MATERIALS AND POLYMERS 9

Abrasives – Natural & synthetic – Moh’s scale, diamond, carborundum – Refractories – classification and properties – Cement – Manufacture. Lubricants- Types – properties of lubricants – oiliness, fire & flash points, pour & cloud point (definition only) – solid lubricants – Graphite and MoS₂.

Polymer and polymerization (definition only)- examples for natural & synthetic polymers, Preparation, properties and uses of Kevlar, Nomex, Rubber – natural and synthetic – neoprene, butyl rubber- vulcanization of rubber, Introduction to Conducting polymers and Liquid crystal polymers.

UNIT III SURFACE CHEMISTRY AND NANOMATERIALS 9

Adsorption – classification- adsorption of gases on solids- adsorption isotherms- Freundlich and Langmuir adsorption isotherms- adsorption of solutes from solution- application of adsorption-catalysis and pollution control- Nanomaterials – introduction – carbon nanotubes (CNT) and their applications.

UNIT IV ANALYTICAL TECHNIQUES 9

Importance of spectroscopic techniques- Beer-Lambert’s law (problem) – UV-visible spectroscopy and IR spectroscopy – principles – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. Thermal Analysis- TGA and DTA- principles- thermogram of calcium oxalate monohydrate.

UNIT-V CHEMICAL KINETICS 9

Introduction – rate, rate constant, order & molecularity of reactions –First order reaction – Derivation of rate constant – Second order reactions – rate constant (no derivation, equation and problem only) - activation energy – concept-Arrhenius equation- derivation- steady state approximation.

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. P.C. Jain and Monica Jain, Engineering Chemistry Dhanpat Rai Pub, Co., New Delhi (2002)
2. S.S. Dara, A text book of engineering chemistry S. Chand & C. Ltd., New Delhi (2006)
3. B. Sivasankar Engineering Chemistry Tate McGraw- Hill Pub. Co. Ltd, New Delhi (2008)

REFERENCES:

1. B. K. Sharma Engineering Chemistry Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. R. Gopalan, D. Venkappayya, Sulochana Nagarajan, Engineering Chemistry Vikas Pub, Co., New Delhi (2006)
3. Principles of physical chemistry by Samuel Glasstone, Van Nostrand pub.comp, Newyork.
4. Principles of physical chemistry by Puri & Sharma, Vikas pub.comp, 2008

OBJECTIVE

- To know the fundamental principles of geometrical drawing
- To visualize the various machine components

Unit I - Introduction**9**

Introduction to Engineering Drawing, Drawing Standard, ISI code of practice, Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Unit II - Orthographic Projection (Points, Lines & Planes)**9**

Principles of orthographic projection-projection of points, straight lines, traces and projection of planes inclined to both planes Orthographic projection of simple engineering components-missing view exercises.

Unit III - Orthographic Projection (Solids)**9**

Projection of solids – Inclined to one plane - Sections and Sectional Views of Right Angular Solids covering - Prism, Cylinder, Pyramid, Cone – Auxiliary Views

Unit IV - Pictorial Projections**9**

Principles of pictorial views, isometric view of simple solids. Free hand sketching of orthographic views from pictorial views. Free hand sketching of isometric views from given two or three views.

Unit V - Development Of Surfaces & Perspective Projection**9**

Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Perspective Projection of Planes and Solids

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

1. Venugopal K and Prabhu Raja V, “Engineering Graphics”, New Age International Publishers, 2007.
2. . Luzadder W J, “Fundamentals of Engineering Drawing”, Prentice Hall Book Co., New York, 1998
3. Bhat, N.D.& M. Panchal , *Engineering Drawing*, Charotar Publishing House,2008

REFERENCES:

1. Kumar M S, “Engineering Graphics”, Ninth Edition, DD Publications, Chennai, 2007.
2. Bureau of Indian Standards, “Engineering Drawing Practices for Schools and Colleges SP 46-2003”, BIS, New Delhi, 2003.
3. Shah, M.B. & B.C. Rana , *Engineering Drawing and Computer Graphics*, Pearson Education,2008

CS1101 FUNDAMENTALS OF COMPUTING AND PROGRAMMING 3 0 0 3

AIM:

To provide an awareness to Computing and Programming

OBJECTIVES:

- To enable the student to learn the major components of a computer system
- To know the correct and efficient ways of solving problems
- To learn to use office automation tools
- To learn to program in C

UNIT - I Introduction to Computers 9

Introduction – Characteristics of Computers – Evolution of Computers - Computer Generations – Classification of Computers – Basic Computer organization – Number Systems

UNIT -II Computer Software 9

Computer Software –Types of Software – Software Development Steps – Internet Evolution - Basic Internet Terminology – Getting connected to Internet Applications.

UNIT – III Problem Solving and Office Application Software 9

Planning the Computer Program – Purpose – Algorithm – Flow Charts – Pseudocode - Application Software Packages- Introduction to Office Packages (not detailed commands for examination).

UNIT – IV Introduction to C 9

Overview of C – Constants, Variables and Data Types – Operators and Expressions – Managing Input and Output operators – Decision Making - Branching and Looping.

UNIT – V Functions and Pointers 9

Handling of Character Strings – User-defined Functions – Definitions – Declarations - Call by reference – Call by value – Structures and Unions – Pointers – Arrays – The Preprocessor – Developing a C Program : Some Guidelines

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ashok.N.Kamthane,“ Computer Programming”, Pearson Education (India) (2008).
2. Behrouz A.Forouzan and Richard.F.Gilberg, “A Structured Programming Approach Using C”, II Edition, Brooks-Cole Thomson Learning Publications, (2007).

REFERENCES:

1. Pradip Dey, Manas Ghoush, “Programming in C”, Oxford University Press. (2007).
2. Byron Gottfried, “Programming with C”, 2nd Edition, (Indian Adapted Edition), TMH publications, (2006).
3. Stephen G.Kochan, “Programming in C”, Third Edition, Pearson Education

- India, (2005).
4. Brian W.Kernighan and Dennis M.Ritchie, “The C Programming Language”, Pearson Education Inc., (2005).
 5. E.Balagurusamy, “Computing fundamentals and C Programming”, Tata McGraw-Hill Publishing Company Limited, (2008).
 6. S.Thamarai Selvi and R.Murugan, “C for All”, Anuradha Publishers, (2008).

CS1171

COMPUTER PRACTICE LAB - I

0 1 2 2

LIST OF EXERCISES

a) Word Processing 15

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

b) Spread Sheet 15

5. Chart - Line, XY, Bar and Pie.
6. Formula - formula editor.
7. Spread sheet - inclusion of object, Picture and graphics, protecting the document and sheet.
8. Sorting and Import / Export features.

c) Simple C Programming * 15

9. Data types, Expression Evaluation, Condition Statements.
10. Arrays
11. Structures and Unions
12. Functions

*** For programming exercises flow chart and pseudo code are mandatory.**

TOTAL: 45 PERIODS

Hardware / Software required for a batch of 30 Students

Hardware

LAN System with 33 nodes (OR) Standalone PCs– 33 Nos.
Printers– 3 Nos.

Software

OS– Windows / UNIX Clone
Application Package– Office suite
Compiler– C

ME1171 COMPUTER AIDED DRAFTING AND MODELING LAB

L-T-D: 0-0-2 Credits: 2

- (i) Introduction to computer aided drafting and solid modeling: software and hardware.
- (ii) Understand basic 2D geometric construction techniques.
 - a. Cartesian and polar coordinate systems: locating points, coordinate entry methods, units and limits.
 - b. Object generation: lines, arcs, polylines, and multilines; rectangles, circles, polygons, and ellipses.
 - c. Transformations: move, copy, rotate, scale, mirror, offset and array; trim, extend, fillet, chamfer
 - d. Layers: creation, naming, properties manager.
 - e. Blocks: create, edit, import and explode.
 - f. Text: creating and editing, formatting, text styles.
 - g. Dimensions: creating and editing, dimension styles.
- (iii) Exercise on basic drafting principles to create technical drawings.
 - a. Create orthographic views of machine parts from pictorial views.
 - b. Create isometric views of machine parts from orthographic views
 - c. Create hatched sectional views of machine parts.
- (iv) Understanding basic solid modeling techniques
 - a. Creation of solid primitives
 - b. Boolean operations
 - c. Extrude, Revolve operations
 - d. 3D Views
- (v) Exercise on basic modeling to create machine parts Create solid models from pictorial views

TOTAL: 45 PERIODS

University Examination:

Question paper may contain two parts. Part A shall contain 2D drafting which carries 40% marks, Part B shall contain 3D drafting which carries 40% marks and 20% marks is for viva voce conducted during the exam.

PH1171

PHYSICS LAB- I

0 0 2 1

LIST OF EXPERIMENTS

(Any five experiments)

1. (a) Particle size determination using Diode Laser
(b) Determination of Laser parameters- Wavelength and Numerical aperture
2. Determination of velocity of sound and compressibility of liquid- Ultrasonic Interferometer.
3. Determination of thermal conductivity of a bad conductor- Lee's Disc method
4. Determination of thickness of a thin wire- Airwedge
5. Torsional Pendulum- Determination of rigidity modulus
6. Compound pendulum- Determination of acceleration due to gravity
7. Determination of Young's Modulus- Non-Uniform bending

Reference: Physics lab manual- Department of Physics

CH1171

CHEMISTRY LAB - I

0 0 2 1

List of Experiments

1. Determination of total hardness of water by EDTA method.
 2. Determination of alkalinity (titrimetry method)
 3. Determination of percentage purity of washing soda
 4. Conductometric titration of a strong acid with a strong base
 5. Determination of strength of hydrochloric acid (p^Hmetry)
 6. Determination of the amount of Na⁺ in water sample (Flame photometry)
 7. Determination of molecular weight and degree of polymerization of a polymer
 8. Determination of the amount of Ca²⁺ in water sample .
 9. Determination of iron in rust by Permanganometry.
- Minimum five experiments shall be offered.

References:

1. J. Bassette, R. B. Deanen & G. H. Jeffery & J. Mendham, Text book of Vogel Quantitative Inorganic Analysis, ELBS, England.

TOTAL: 45 PERIODS

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B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER II

(Common for All B.E/B.Tech Programmes Except Marine Engineering)

Sl. No	Course Code	Course Title	L	T	P	C
Theory						
1.	EG1102	Technical English – II	3	0	0	3
2.	MA1102	Engineering Mathematics – II	3	1	0	4
3.	PH1102	Engineering Physics – II	3	0	0	3
4.	CH1102	Engineering Chemistry – II	3	0	0	3
5.	ME1102	Engineering Mechanics	3	0	0	3
6.	BE1101	Basic Engineering - I (Basic Electrical and Electronics Engineering)	3	1	0	4
7.	BE1102	Basic Engineering – II (Basic Mechanical and Civil Engineering)	3	1	0	4
Practical						
8.	CS1172	Computer Practice Lab - II	0	1	2	2
9.	PH1172	Physics Lab – II	0	0	2	1
10.	CH1172	Chemistry Lab - II	0	0	2	1
11.	BE1171	Basic Engineering Lab – I (Basic Electrical and Electronics Engineering Lab)	0	0	4	2
12.	BE1172	Basic Engineering Lab – II (Basic Mechanical and Civil Engineering Lab)	0	0	4	2
TOTAL			21	4	14	32

***Those who have admitted from the Academic Year 2013-2014 onwards.**

EG1102

TECHNICAL ENGLISH - II

3 0 0 3

UNIT-I

9

Technical Vocabulary - Active and Passive Vocabulary – Articles - Prepositions – Expansion of Abbreviations and Acronyms

UNIT-II

9

Phrases- Adverbs –Different grammatical forms of the same word –Active Voice-Passive Voice

UNIT-III

9

Phonemes - Vowels, Consonants and Diphthongs – Word Stress and Intonation

UNIT-IV

9

Writing Recommendations – Checklists - Essay Writing - Business Letters: - Letter Calling for quotation, Letter Placing Order, Letter of Complaint, Letter Seeking Clarification - Business Proposal Writing

UNIT-V

9

Numerical Adjectives – CV/Resume Writing – One Word Substitutes – Virtual Communication: E-Mail Writing

TOTAL: 45 PERIODS

TEXT BOOK:

Department of Humanities and Social Sciences, Anna University, English for Engineers and Technologists, Combined Edition (Volumes 1 @ 2), Chennai: Orient Black Swan Pvt.Ltd. 2006 Themes 5-8 (Technology, Communication, Environment, Industry)

EXTENSIVE READING:

Shiv Khera, You Can Win, Milan, Delhi, 2004

OR

CanField Jack, Chicken Soup for the Soul, Westland, Chennai, 1999.

NOTE:

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

AIM:

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve a well founded knowledge about the principles of Mathematics.

OBJECTIVE:

To develop basic knowledge to the students in differential equations and vector calculus. This subject is further broadened to the functions of complex variables and complex integration. A thorough knowledge about Laplace transforms is also covered to aid the students solve the differential equations.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS**9**

Linear differential equations of second order with constant and variable coefficients- Cauchy's and Legendre's linear equations – Method of variation of parameters

UNIT II COMPLEX VARIABLES**9**

Functions of a complex variable – Analytic function – Necessary conditions- Cauchy-Riemann equations in cartesian and polar co-ordinates - Sufficient conditions(excluding proof) – Properties of analytic function – Harmonic and its conjugate – Construction of analytic function by Milne Thomson method – Conformal mappings
 $w = z + c$, cz , $1/z$ and Bilinear transformation.

UNIT III COMPLEX INTEGRATION**9**

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula – Laurent's expansion – Singular points – Residues – Cauchy's Residue theorem – Evaluation of real definite integral using contour integration(excluding poles on the real

axis) - $\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta$ and $\int_{-\infty}^{\infty} \frac{f(x)}{g(x)} dx$

UNIT IV VECTOR CALCULUS**9**

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 parallelepipeds.

UNIT V LAPLACE TRANSFORMS**9**

Laplace transform – Existence condition– Transforms of elementary functions – Basic properties – Transforms of derivatives and integrals – Transform of Periodic functions. Inverse Laplace transform – Convolution, Initial and Final value theorems (statement only) – Solutions of linear ordinary differential equation of second order with constant coefficients using Laplace transform techniques.

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

TEXT BOOK:

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

REFERENCES:

1. Erwin Kreyszig, "Advanced engineering Mathematics", 7th Edition, Wiley India, 2007
2. Veerarajan T, "Engineering Mathematics (for first year)", Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2007.
3. P.Kandasamy , K.Thilagavathy , K.Gunavathy" Engineering Mathematics" S.Chand & Company Ltd.2002.
4. B.V. Ramana,"Higher Engineering Mathematics" Tata McGraw- Hill Publishing Company Ltd.,New Delhi,2006.

PH1102**ENGINEERING PHYSICS – II****3 0 0 3****AIM:**

To enable the students' understand the Physics behind various engineering materials and correlate it to technological applications.

OBJECTIVE:

At the end of the course students would be exposed to

- Fundamentals of quantum mechanics and its application to electron microscopy
- Various crystal structures and their defects
- The synthesis, properties and applications of various engineering materials

UNIT –I Quantum Mechanics**9**

Matter waves- de-Broglie wavelength - Schrodinger's wave equation-time independent and time dependent equations- physical significance of wave function- particle in a one dimensional box- electron microscope- scanning electron microscope- transmission electron microscope.

UNIT II Elementary crystal physics**9**

Lattice – Unit cell, Bravais lattice ,lattice planes-Miller indices ,d-spacing in cubic lattice. Calculation of number of atoms per unit cell,atomic radius, coordination number and packing factor for SC,BCC,FCC and HCP structures- diamond cubic, NaCl and ZnS structures. Crystal defects.

UNIT- III Conducting & Semiconducting Materials**9**

Conducting materials – Drawbacks of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states Semiconducting materials: intrinsic semiconductor-carrier concentration derivation

- fermi level - electrical conductivity- band gap determination, extrinsic semiconductors, compound semiconductors (qualitative), Hall effect -determination of hall coefficient - applications.

UNIT- IV Magnetic, Superconducting and Dielectric Materials **9**

Magnetic Materials: Origin of magnetic moment-Bohr magneton - ferromagnetism – magnetic domains- hysteresis-soft and hard magnetic materials- applications.

Superconductivity: Properties-types of super conductors - BCS theory of superconductivity (qualitative) - applications of superconductors.

Dielectric materials - active and passive dielectrics - types of polarization- dielectric loss- dielectric breakdown – uses of dielectric materials.

UNIT- V New Engineering Materials **9**

Metallic glasses: preparation, properties and applications. Shape Memory Alloys (SMA): characteristics, properties and applications.

Nanomaterials -synthesis-top-down approach (Ball milling), bottom-up approach (CVD)- properties and applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rajendran, V, and Marikani A, ‘Materials science’ TMH publications, New Delhi
2. Palanisamy P.K “Materials Science”, Scitech publications Pvt Ltd, Chennai
3. Arumugam M, “Materials Science”, Anuradha publications, Kumbakonam
4. R.K. Gaur and S.L.Gupta, ‘Engineering Physics’ Dhanpat Rai publications, New Delhi

REFERENCES:

1. Charles Kittel ,” Introduction to solid state physics “, John Wiley & sons, 8ed.
2. Charles P.Poole and Frank J. Owner, “ Introduction to Nanotechnology, Wiley India.
3. Pillai, S.O. ‘Solid state physics’ NewAge international publishers, Chennai.

CH1102

ENGINEERING CHEMISTRY-II

3 0 0 3

AIM

To have a thorough knowledge of the basics of chemistry particularly engineering oriented topics to engineering students

OBJECTIVES

To make the students conversant with the principles of the following topics: (i) Fuels And Combustion,(ii) Electrochemistry And Corrosion, (iii) Energy Sources And Batteries, (iv) Phase Rule And Alloys And (v) Thermodynamics.

UNIT I FUELS AND COMBUSTION**9**

Classification of fuels with examples– characteristics of a good fuel- fossil fuels- Coal – proximate and ultimate analysis- metallurgical coke – manufacture by Otto-Hoffmann method – Petroleum processing and refining – cracking (definition only) - knocking – octane number and cetane number – synthetic petrol – Bergius process- Calorific value –GCV, LCV (problems)- Gaseous fuels- water gas and producer gas, Flue gas analysis – Orsat apparatus – theoretical air for combustion (problems).

UNIT-II ELECTROCHEMISTRY AND CORROSION**9**

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – single electrode potential – Nernst equation– reference electrodes – Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance- Electrochemical corrosion – protective coatings – paints – constituents and functions.

UNIT -III ENERGY SOURCES AND BATTERIES**9**

Renewable & non-renewable energy sources- wind energy, solar energy and solar cell- Nuclear reactions – Fission and fusion – nuclear reactors – light water and breeder nuclear reactors (elementary ideas only) – Nuclear power plants in India. Batteries- primary and secondary cells- alkaline battery- lead acid battery- nickel cadmium battery- lithium battery (Li-TiS₂)- H₂-O₂ fuel cell.

UNITV PHASE RULE AND ALLOYS**9**

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

UNIT-V THERMODYNAMICS**9**

Introduction- I law of thermodynamics (statement only)- Relation between ΔE & ΔH -II law of thermodynamics (statement only)- concept of entropy – Clausius-Clapeyron equation (no derivation)- Importance, terms involved (problem) -Free energy changes- ΔG – Gibbs Helmholtz equation (derivation) - III law of thermodynamics- concept of absolute entropy- zeroth law of thermodynamics (statement only).

TOTAL: 45 PERIODS**TEXT BOOKS:**

- 1 P.C. Jain and Monica Jain, Engineering Chemistry DhanpatRai Pub, Co., New Delhi (2002)
- 2 S.S. Dara, A text book of engineering chemistry S. Chand & C. Ltd., New Delhi (2006)
3. B. Sivasankar Engineering Chemistry Tate McGraw- Hill Pub. Co. Ltd, New Delhi (2008).

REFERENCES:

- 1 B. K. Sharma Engineering Chemistry Krishna Prakasan Media (P) Ltd., Meerut (2001)
- 2 Principles of physical chemistry by Samuel Glasstone, Van Nostrand pub.comp, Newyork.
- 3 Principles of physical chemistry by Puri & Sharma, Vikas pub.comp, 2008.

ME1102

ENGINEERING MECHANICS

3 0 0 3

OBJECTIVE

This is a basic engineering course common to all branches to inculcate in the students, problem solving abilities and to enhance their analytical abilities.

Unit I - Statics of Particles

10

Statics –Basics Concepts, Fundamental principles & concepts: Vector algebra, Newton’s laws, gravitation, force (external and internal, transmissibility), couple, moment (about point and about axis), Varignon’s theorem, resultant of concurrent and non-concurrent coplanar forces, static equilibrium, free body diagram, reactions. Problem formulation concept; 2-D statics, two and three force members, alternate equilibrium equations, constraints and static determinacy; 3-D statics.

Unit II - Application of Statics & Friction

9

Analysis of Structures- Trusses: Assumptions, rigid and non-rigid trusses; Simple truss (plane and space), analysis by method of joints. Analysis of simple truss by method of sections;

FRICITION: Friction- Coulomb dry friction laws, simple surface contact problems, friction angles, types of problems, wedges. Sliding friction and rolling resistance

Unit III - Centroid, Centre of Gravity and Moment of Inertia

8

Moment of Inertia- First moment of mass and center of mass, centroids of lines, areas, volumes, composite bodies. Area moments- and products- of inertia, radius of gyration, transfer of axes, composite areas. Rotation of axes, principal area-moments-of-inertia,. Second moment of mass, Mass moments- and products- of inertia, radius of gyration, transfer of axes, flat plates (relation between area- and mass- moments- and products- of inertia), composite bodies. Rotation of axes, principal mass-moments-of-inertia.

Unit IV - Particle Dynamics

8

Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton’s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

Unit V Kinematics & Kinetics of Rigid Bodies:

10

Plane kinematics of rigid bodies- Rotation; Parametric motion. Relative velocity,

instantaneous center of rotation. Relative acceleration, rotating reference frames. Rotating reference frames, 3-part velocity and 5-part acceleration relations, Coriolis acceleration. Plane kinetics of rigid bodies- Kinetics of system of particles and derivation of moment equation. Translation. Fixed axis rotation; General planar motion.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Beer F P and Johnson E R, “Vector Mechanics for Engineers, Statics and Dynamics”, Tata Mc-Graw Hill Publishing Co. Ltd., New Delhi, 2006.
2. Tayal A K, “Engineering Mechanics- Statics and Dynamics” , Umesh Publications, Delhi,2004
3. Irving H. Shames, Engineering Mechanics, Prentice Hall, New Delhi 1997.

REFERENCES:

1. Bansal R K, “Engineering Mechanics”, Laxmi Publications Pvt. Ltd., New Delhi, 2006.
2. Bhavikatti S S, “Engineering Mechanics”, New Age International Pvt. Ltd., New Delhi, 2003.
3. Young D H and Timashenko S, “Engineering Mechanics”, Tata Mcgraw-Hill, Fourth Edition, 2006.
4. Jivan Khachane, Ruchi Shrivastava, “Engineering Mechanics: Statics and Dynamics”, ANE Books, 2006.
5. Rajasekaran S and Sankarasubramanian G, “Engineering Mechanics-Statics and Dynamics”, Vikas Publishing House Pvt. Ltd., New Delhi, 2006.
6. NPTEL courses: <http://nptel.iitm.ac.in/courses.php>, web and video resources on *Engineering Mechanics*.

BE1101

BASIC ENGINEERING - I

3 1 0 4

(Basic Electrical and Electronics Engineering)

Objectives:

- To understand the basic solutions of AC and DC circuits.
- To study the basic principle and operation of AC and DC machines.
- To study the fundamental operations of measuring instruments.
- To study the layout of power system.

Unit: 1 – Electrical circuits

9

Ohms Law, Kirchoff’s laws, Mesh and Nodal Analysis for DC Circuits. Introduction to AC Circuits, Faraday’s Law of Electromagnetic Induction, Lenz law, Inductor, Capacitor, Power factor, Waveforms and RMS value, Average Value, Peak factor and Form factor, Single phase circuits- Series and Parallel, Three phase balanced circuits. Fundamentals of wiring and earthing.

Unit: II – Electrical Measurements, Machines and Power system 9

Operating principles of Moving coil and Moving iron instruments (Ammeter and voltmeter), Dynamometer type watt meter and Energy meter, Errors in Measurements. Construction, Principle of operation and Applications of DC Generators, DC Motors, Single phase transformers. Structure of power system

UNIT- III Semiconductor devices and applications 9

Characteristics of PN Junction diode-Zener Effect-Zener diode and its characteristics-Half wave and Full wave Rectifiers-Voltage regulation,Bipolar Junction transistor-CB,CE,CC Configuration and characteristics.

UNIT-IV Digital Electronics 9

Binary number system-logic gates-Boolean algebra-Combinational Circuit-half and Full adder,Sequential Circuit-Flip flops-Shift Registers(SIPO,SISO,PIPO,PISO) – Counters: Synchronous and Asynchronous –A/D conversion-Successive approximation,D/A conversion-Weighted Resistor

UNIT – V Fundamentals of Communication Engineering 9

Types of Signals: Analog and Digital Signals – Modulation and Demodulation – Principles of Amplitude and Frequency modulation – Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fiber (Block Diagram)

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

TEXT BOOKS:

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. V.K.Mehta “Principles of Power System”, S.Chand & Company Ltd, New Delhi, 2001.
3. R.S.Sedha,”Applied electronics”S.Chand&Co.,2006.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Chakrabarti A, Soni M.L, Gupta P.V, Bhatnagar U.S , “ A Text book on Power System Engineering,” Dhanpat Rai & Co, New Delhi,2010.
4. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basc Electrical Electronics and Computer engineering”,Tata McGraw Hill, Second edition(2006).
5. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford Press(2005).
6. Mehta V K, “Principles of Electronics”,S.Chand&Company Ltd(1994).
7. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series McGraw Hill,(2002).
8. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers,(2003)

BE1102

BASIC ENGINEERING – II
(Basic Mechanical and Civil Engineering)

3 1 0 4

Aim:

To introduce students to the profession of Mechanical and Civil Engineering and involve them in small-scale projects which would allow them to develop teamwork skills.

Objective:

- To understand the basic knowledge about the Mechanical components used in various application
- To be aware of the different fields of Civil Engineering, such as Surveying, Structural and Transportation Engineering.

Unit I – IC Engine and Boilers

9

IC Engines: Working and comparison of two stroke and four stroke petrol and diesel engines - general description of various systems using block diagrams – air system, fuel system and ignition system. A brief description of CRDI, MPFI, GDI and Hybrid Vehicles.

Steam boilers: Classification – Cochran boiler, Babcock and Wilcox boiler, High pressure Boilers - Lamont, Benson boiler

Unit II – Compressor, Blower, Pumps, Power plants, Refrigeration and Air Conditioning

9

Principles and fields of application of compressors - reciprocating and centrifugal, blower principle, pumps- reciprocating, and centrifugal pumps steam

Elementary ideas of hydroelectric, thermal and nuclear power plants

Refrigeration & Air Conditioning: Refrigerants, Vapor compression system, Vapor absorption system window air conditioning unit -types (general description only).

Unit III – Manufacturing Processes

9

Basic Principles of Manufacturing processes – casting, metal forming - forging, rolling, Metal joining - soldering, Welding Machining processes- Lathe construction, operation - turning, taper turning, thread cutting

UNIT - IV Civil Engineering and Materials

9

Introduction: Civil Engineering, branches of Civil Engineering, contribution to society, Scope,

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections, glass, wood, FRP

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

Sub Structure: Types, Bearing capacity – Requirement of good foundations.

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering– Types of Bridges and Dams

UNIT- V Civil Engineering structures

Building planning

9

Residential, Institutional and industrial – functional requirements. – Basics of Interior Design and Landscaping.

Roads- benefits- classifications- traffic signs

Bridges-components od bridges-Dam-Purpose of reservoir.

Environmental Engineering: Protected water supply, water treatment methods-sewage treatment- Pollution-Types-causes-remedial measures

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

TEXT BOOKS

- 1) Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kr. Jain, “Basic Civil Engineering”, Laxmi Pulications,
- 2) Roy and Choudhary, “*Elements of Mechanical Engineering*”
- 3) J Benjamin, “*Basic Mechanical Engineering*”

References

1. K.Venugopal and v prabu raja “*Basic Mechanical Engineering*” Anuradha Agencies
2. Shanmugam G and Palanichamy M.S “*Basic Mechanical Engineering*” Tata MC Graw Hill.
3. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”,Tata McGraw Hill Publishing Co., New Delhi, (1996).
4. Ramamrutham. S, “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).
5. Seetharaman S. “Basic Civil Engineering”, Anuradha Agencies, (2005).

CS1172 COMPUTER PRACTICE LAB – II 0 1 2 2

Prerequisite: None

List of Experiments

1. **Unix Commands** 15
Study of Unix OS - Basic Shell Commands - Unix Editor
2. **Shell Programming** 15
Simple Shell program - Conditional Statements - Testing and Loops
3. **C Programming on Unix** 15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL: 45 PERIODS

Hardware / software requirements for a batch of 30 students

Hardware

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

Software

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

PH1172

PHYSICS LAB - II

0 0 2 1

LIST OF EXPERIMENTS

(Any five experiments)

1. Determination of focal length of convex lens- Newtons Rings
2. Determination of wavelength of mercury spectrum- Spectrometer grating
3. Determination of Viscosity of a liquid- Poiseuille's method.
4. Determination of hysteresis loss in a ferromagnetic material.
5. Determination of dielectric constant of a material at room temperature.
6. Determination of band gap of a semiconducting material.
7. Determination of Young's modulus- Uniform bending.

REFERENCE: Physics lab manual- Department of Physics

CH1172

CHEMISTRY LAB- II

0 0 2 1

LIST OF EXPERIMENTS

1. Determination of concentration of ferrous ion by potentiometry.
 2. Conductometric titration of mixture of acids.
 3. Estimation of copper in brass by EDTA method.
 4. Determination of chloride content in water sample by argentometry.
 5. Determination of acidity by titrimetry.
 6. Determination of iron content in a solution by spectrophotometric method.
 7. Determination of amount of water of crystallization in hydrated barium chloride.
 8. Percentage purity of limestone (permanganometry)
- Minimum five experiments shall be offered.

TOTAL: 45 PERIODS

REFERENCES:

1. J. Bassette, R. B. Deanen & G. H. Jeffery & J. Mendham, Text book of Vogel Quantitative Inorganic Analysis, ELBS, England.

BE1171

BASIC ENGINEERING LAB – I
(Basic Electrical and Electronics Engineering Lab)

0 0 4 2

I. Electrical Engineering Lab

- 1 Study of Symbols, Cables and Earthing.
- 2 Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- 3 Fluorescent lamp wiring.
- 4 Stair case wiring / Lamp control from three different places/ Doctor Room control/ Go down control
- 5 Measurement of electrical quantities – voltage, current, power & computation of power factor in RLC circuit.
- 6 Measurement of energy using single phase energy meter.
- 7 Fan Wiring.

II. Electronics Engineering Lab

- 1 Study of Electronic components and equipments – Resistor, colour coding, Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
- 2 Study of logic gates AND, OR, EX-OR and NOT, NAND and NOR.
- 3 Generation of Clock Signal.
- 4 Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
- 5 Measurement of ripple factor of HWR and FWR.
- 6 Characteristics of PN Junction diode
- 7 Characteristics of Zener diode
- 8 Voltage Regulator using Zener diode

TOTAL: 45 PERIODS

BE1172

BASIC ENGINEERING LAB – II
(Basic Mechanical and Civil Engineering Lab)

0 0 4 2

OBJECTIVE:

Introduction to different materials in engineering practices with respect to their workability, formability & machinability with hand tools & power tools and to develop skills through hands on experience.

I. Mechanical Engineering Lab

1. Welding - Metal arc welding tools and equipment, exercises.
2. Fitting - Tools, operations, exercises, types of joints. (*Term work to include one job involving fitting to size, male-female fitting with drilling and tapping.*)

3. Foundry- Tools, preparation of moulding sand, patterns, cores, foundry exercises.
4. Carpentry- Tools, carpentry process, carpentry exercises, types of joints.
5. Assembly and Inspection.(*Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments.*)
6. Machine Tools I - Demonstration of drilling machine.
7. Machine Tools II - Demonstration of Lathe.
8. Study of Automobile and Power Transmission.
9. Wood working - Demonstration of wood working machinery and furniture manufacturing.(*Term work includes one job involving joint and woodturning*)

II. Civil Engineering Lab

Buildings:

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

Plumbing Works:

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

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture.
- (b) Hands-on-exercise: Wood work, joints by sawing, planing and cutting.
- (c) Demonstration of elementary surveying techniques

TOTAL: 45 PERIODS

List of equipment and components (For a Batch of 30 Students)

- | | |
|--|---------------------------------------|
| 1. Assorted components for plumbing consisting of metallic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. | plastic pipes,

15 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 Tools: | |

- | | |
|---------------------------|--------------|
| (a) Rotary Hammer | 2 Nos |
| (b) Demolition Hammer | 2 Nos |
| (c) Circular Saw | 2 Nos |
| (d) Planer | 2 Nos |
| (e) Hand Drilling Machine | 2 Nos |
| (f) Jigsaw | 2 Nos |

6. Surveying equipment for Demonstration

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER-III

<i>Sl. No</i>	<i>Course Code</i>	<i>Course Title</i>	L	T	P	C
THEORY						
1.	MA1202	Numerical Methods & Transforms	3	1	0	4
3.	BM1201	Bio Sensors and Transducers	3	0	0	3
3.	BM1202	Bio Physics	3	1	0	4
4.	BM1203	Semiconductor Devices & Circuits	3	1	0	4
5.	BM1204	Human Anatomy and Physiology	3	0	0	3
6.	BM1205	Biochemistry	3	0	0	3
PRACTICALS						
7.	BM1271	Semiconductor Devices & Circuits Lab	0	1	2	2
8.	BM1272	Biochemistry and Human Physiology Lab	0	1	2	2
9.	BM1273	Sensors and Transducers Lab	0	1	2	2
TOTAL			18	6	6	27

AIM:

To impart the fundamental knowledge of Engineering Mathematics to the students in order to achieve some knowledge about the principles of Mathematics.

OBJECTIVE:

To develop the skill of the students in the areas of Transform techniques and numerical analysis. This will be necessary for their effective studies in a large number of Engineering applications namely communication systems, electro-optics and electromagnetic theory. This course will also serve as a prerequisite for post graduate and specialized studies in research.

UNIT I LINEAR AND NON LINEAR EQUATIONS**9**

Solution of non-linear equations-Method of false position, Newton Raphson method , Fixed point iteration method – Solution of linear system of Equations-Direct methods: Gauss Elimination and Gauss-Jordan methods – Iterative methods: Gauss Jacobi and Gauss – Seidel methods- Inverse of a matrix by Gauss-Jordan method.

UNIT II FIRST AND SECOND ORDER ORDINARY DIFFERENTIAL EQUATIONS**9**

Solution of first order differential equations -Single step Methods : Taylor's Series, Euler, Modified Euler methods and Fourth order Runge-Kutta method. Multi-step methods : Milne's and Adam's predictor and corrector methods

UNIT III FOURIER SERIES**9**

Introduction-Fourier series– Dirichlet's conditions – Euler's formulae - General Fourier Series - Even and odd functions - Half range series - Parseval's identity –Harmonic Analysis

UNIT IV FOURIER TRANSFORMS**9**

Fourier integrals - Fourier sine and cosine integral- Complex form of Fourier integral – Fourier transform pair – Fourier Sine and Cosine transforms pairs– Properties - Convolution theorem – Parseval's identity

UNIT V Z-TRANSFORMS**9**

Z- transform – Properties -Standard results - Inverse Z-transform - convolution theorem– Evaluation of inverse Z - transform – Application –Second order difference equations

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

1. Grewal B.S., "Higher Engineering Mathematics" – 40th Edition , Khanna Publishers, Delhi 2007.
2. Gerald, C.F, and Wheatley, P.O, "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2002.

REFERENCES:

1. Ramana B.V., "Higher Engineering Mathematics" Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 2007
2. Veerarajan T., "Engineering Mathematics (for Semester III), Tata McGraw – Hill Publishing Company Limited, New Delhi .2007
3. Narayanan. S, Manicavachagam Pillay T.K., Viswanathan. S, Ramaniah. G., "Advanced Mathematics for Engineering students", Volumes II & III, Viswanathan. S(Printers and Publishers) Pvt Ltd. Chennai 2002
4. Balagurusamy, E., "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1999
5. Kandasamy, P. Thilakavathy, K and Gunavathy, K. "Numerical Methods". S.Chand and Co. New Delhi, 2008

BM1201

BIO SENSORS AND TRANSDUCERS

3 0 0 3

UNIT I: SCIENCE OF MEASUREMENT

7

Measurement System – Instrumentation – Classification and Characteristics of Transducers – Static and Dynamic – Errors in Measurements – Calibration – Primary and secondary standards.

UNIT II: CLASSIFICATION OF TRANSDUCERS

11

Temperature transducers: Resistance temperature detector (RTD), Thermistor, Thermocouple, chemical thermometry, Displacement transducers: potentiometer, resistive strain gauges, inductive displacement, capacitive displacement transducer, Pressure transducer: variable capacitance pressure transducers, strain gauge transducers, semiconductor transducers, catheter tip transducers, Flow transducer

UNIT III: PHOTOELECTRIC AND PIEZO ELECTRIC SENSORS

9

Phototube, scintillation counter, Photo Multiplier Tube (PMT), photovoltaic, photoconductive cells, photo diodes, phototransistor, Piezo-electric active transducer and Ultrasound transducer.

UNIT IV: BIOCHEMICAL TRANSDUCERS

9

Electrode theory: electrode-tissue interface, metal-electrolyte interface, electrode-skin interface, electrode impedance, Biopotential electrodes: microelectrodes, body surface electrodes, needle electrodes, electrodes for ECG, EEG, and EMG. Reference electrodes: hydrogen electrodes, silver-silver chloride electrodes, Calomel electrodes, Ion electrodes: specific ion electrodes, pH electrode, O₂ electrode, CO₂ electrode.

UNIT V: BIOLOGICAL SENSORS

8

Sensors / receptors in the human body, Chemoreceptor: hot and cold receptors, barro receptors, sensors for smell, sound, vision, Ion exchange membrane electrodes, enzyme electrode, glucose sensors, immune sensors, Basic principles of Nano sensors & BIOMEMS, basic idea about Smart sensors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 2007.
2. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 2004

REFERENCE BOOKS:

1. Ernest o Doebelin and dhanesh N manik, Measuremet systems, Application and design ,5th edition ,McGraw-Hill, 2007.
2. Principles of Applied Biomedical Instrumentation L.A Geddas and L.E.Baker – John Wiley and sons,
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.
4. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

BM1202

BIOPHYSICS

3 1 0 4

UNIT I: BIOELECTRICITY

9

Membrane Potential, Local and propagator types, Diffusion potential, phase boundary potentials, Generator Potentials, compound Action Potentials (AP), Propagation of AP, factors influencing propagation of AP, Bio-signal and types, Electrical properties of excitable membranes, Membrane Capacitance, Resistance, conductance, dielectric properties of membrane, space and time constant for excitable membrane, equivalent electrical circuit diagram for excitable membranes and neural membranes.

UNIT II: ELECTRICAL STIMULUS & BIOPHYSICAL ACTIVITY

9

Stimuli, Receptor potential, pacemaker potential, strength-duration relationship, skin impedance, total body impedance, impedances at high frequencies, Electrical activity of brain (EEG), different wave forms & their characteristics, Electrical activity of heart (ECG), waveform and significance, Electrical activity of muscles (EMG) and muscle tone, Electro-RetinoGram (ERG), Electro-Occologram (EOG)

UNIT III: RADIOACTIVITY

9

Ionizing radiations, U-V & I-R radiations, Production of radioisotopes & their use in biomedical research, Radioactive decays, Half life period, Linear Energy Transfers (LET), Relative Biological Efficiency (RBE) and Interaction of radiation with-matter

UNIT IV: GENETIC EFFECT OF RADIATION

9

Radio sensitivity protocol of different tissues in human, LD 50/30 effect of radiation on skin, Threshold of linear dose effect, relationship, factors affecting frequency of radiation induced mutation, Gene controlled hereditary diseases, biological effect of microwave and RF wave.

Variation in dielectric constant and specific conductivity of tissues. Penetration and propagation of signals effects in various vital organs, Protection standards.

UNIT V: PHOTO MEDICINE & LASER PHYSICS

9

Synthesis of Vitamin D in early and late cutaneous effects, Phototherapy, Photo hemotherapy, exposure level, hazards and maximum permissible exposures. Characteristics of Laser radiation, Laser speckle, biological effects, laser safety management.

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

TEXT BOOKS :

1. Radiation Biophysics, Second Edition - by Edward L. Alpen - Academic Press; 2 edition
2. Bio-Physics – Roland Glaser- Springer; 2nd printing edition (November 23, 2004)
3. Glasser.O.Medical Physics Vol.1,2,3 year Book Publisher Inc Chicago, 1980

REFERENCES:

- 1.Branski.S and Cherski.P ‘Biological effects of Microwave’ Hutchinson & ROSS Inc. Strondsburg 1980
2. Text book of Medical Physiology- Guyton
3. The Biomedical Engineering Hand Book- 3 rd Ed- (Biomedical Engineering Fundamentals) - Joseph D. Bronzino – CRC –Tylor- Francis – 2006 (Section- III – Bio-Electrical Phenomena)

BM1203

SEMICONDUCTOR DEVICES AND CIRCUITS

3 1 0 4

AIM

The aim of this course is to familiarize the student with the analysis and design of basic transistor amplifier circuits, power amplifiers, feedback amplifiers, wave shaping, multivibrator circuits and power supplies.

OBJECTIVES

On completion of this course, the student will understand

- The basic concepts of construction and working of Electron devices
- The methods of biasing transistors.
- Design of simple amplifier circuits.
- Analysis of Oscillators, power amplifiers, wave shaping circuits and multi vibrators.
- Analysis of power supplies.

UNIT –I

SEMICONDUCTOR DIODE AND TRANSISTORS

9

PN Junction diode-structure, operation, characteristics, parameters - Junction capacitance – Zener diode –operation, characteristics and parameters–Transistor- Types, structure, operation, characteristics and parameters. JFET-structure, operation, characteristics and

parameters, MOSFET- D-MOSFET, E-MOSFET –MOSFET characteristics and parameters.UJT –Characteristics, saw tooth oscillator.

UNIT – II TRANSISTOR BIASING 9

Transistor biasing- DC load line – AC load line- Q point.BJT biasing-Voltage divider bias circuits, base bias circuits, collector feedback bias circuits –stability over temperature, bias stabilization, thermal runaway and thermal stability- JFET biasing-self bias, voltage divider bias- MOSFET biasing- zero bias, voltage divider bias, drain feedback .

UNIT –III AMPLIFIERS 9

CE, CC and CB 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 and output impedance-Frequency response - RC coupled amplifier-Classification of Power amplifiers-Class A, B, AB and C Power amplifiers-Push-Pull and Complementary Symmetry Push-Pull amplifiers - power output, efficiency and cross-over distortion.

UNIT –IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Feedback connection types -Negative feedback - Voltage/current, series/shunt- Positive feedback - Condition for oscillation - RC Phase shift - Wein Bridge – Hartley - Colpitts and crystal oscillators.

UNIT –V PULSE CIRCUITS AND POWER SUPPLIES 9

RC wave shaping circuits - Diode clampers and clippers – Multivibrators –Schmitt triggers - Rectifiers- HWR, FWR, Bridge-Filters -Capacitor, inductor ,RC, LC filter - series voltage regulator - Switched mode power supplies.

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

TEXT BOOK

1. Electronic Devices and Circuit Theory - Robert L.Boylestad Louis Nashesky - Rourson Eduction Asia, 2002.

REFERENCE

1. Electronic Devices and Circuits – David A. Bell - Prentice Hall Publications
2. J.Millman, C.C.Halkias, and Satyabratha Jit, “Electronic Devices and Circuits” Tata McGraw Hill, 2nd Ed., 2007.
3. P. Ramesh Babu, “Electronic Devices and Circuits” Scitech Publications Pvt, Ltd., 2008

BM1204 HUMAN ANATOMY AND PHYSIOLOGY 3 0 0 3

AIM

- To provide the students necessary exposure of Human Anatomy so as to understand functioning of Bio- Medical equipment in future semester curriculum.

- To understand the functioning of the various physiological system.

OBJECTIVES

- To have a clear understanding of Anatomy of every vital organ.
- To give the idea of functioning of cardiac, nervous, digestive and respiratory system.
- To understand special sensing units responsible for hearing and vision.

UNIT I: SKELETAL & MUSCULAR SYSTEMS

9

The Skeletal System: Skeleton, Functions of skeleton, Classification of bones, Study of joints - Structure and function of a Synovial joint. The Muscular System: Types of Muscles in the body - The characteristics, structure and functions of the Skeletal Muscles, Smooth Muscles and Cardiac Muscles.

UNIT II: CARDIAC AND NERVOUS SYSTEM

10

Structure of Heart, Pericardium, Chambers, Major Blood Vessels, Blood Supply. Cardiac Cycle – ECG – Blood Pressure – Feedback Control for Blood Pressure – Nervous control of Heart. Cardiac output – Coronary and Peripheral Circulation – Structure of Nervous System – Functions of Neurons, Synapse, Reflexes and Receptors, Brain, Brainstem, Ventricles and Spinal Cord. Peripheral and Automatic Nervous System and function of Nervous tissue – Reflex action – Velocity of Conduction of Nerve Impulses. Electro Encephalograph – Autonomic Nervous System.

UNIT III: RESPIRATORY SYSTEM

8

Respiratory System - Trachea and Lungs. Physiological aspects of respiration. Exchange of gases – Regulation of Respiration. Disturbance of respiring function. Pulmonary function test.

UNIT IV : DIGESTIVE AND EXCRETORY SYSTEM

9

Organization of GI system, Digestion and absorption – Movement of GI tract – Structure of Nephron – Mechanism of Urine formation – Urine Reflex – Skin and Sweat Gland – Temperature regulation.

UNIT V: SPECIAL SENSES & REPRODUCTIVE SYSTEM

9

Special senses: Eye - Structure of Eye ,Optics of Eye – Retina - Photochemistry of Vision – Accommodation Neurophysiology of Vision – EOG. Ear – Structure of Ear, Physiology of Internal Ear - Mechanism of Hearing – Auditory pathway, Hearing Tests.

Human Reproductive System: Male reproductive system - Female reproductive system

TOTAL: 45 PERIODS

TEXT BOOK

1. Ranganathan T.S, “Text Book of Human Anatomy”, S.Chand & Co., Ltd, Delhi, 1996.
2. Sarada Subramanyam, K.Madhavan Kutty and H.D.Singh – Text book of ‘Human Physiology’ – S.Chand & Company, 1996.(Unit I –IV).
- 3.Sujit K.Chaudhuri – Concise Medical Physilogy – New Central Book agency, 1997. (Unit V)

REFERENCES

1. Arthur.C.Guyton – Textbook of Medical Physiology – Prism Book (p) Ltd. 1996.
2. Cyril A.Keele Eric Neil and Neil Norman Joels Samson Wrigths’ Applied Physiology – Oxford University Press – 1983.
3. Tobin C.E., “Basic Human Anatomy”, McGraw-Hill Publishing Co., Ltd., Delhi 1997.
- 4.Gibson .J, “Modern Physiology & Analomy for nurses”, Blackwell SC Publishing 1981.

BM1205

BIOCHEMISTRY

3 0 0 3

AIM

1. To give a clear picture about various chemical activities taking place at cellular level.
2. To understand the various chemical activities taking place in blood, muscles and at neuromuscular junctions.

OBJECTIVES

- To study the biochemical activities taking place at cellular level.
- To study the chemical composition of blood and urine in normal and abnormal conditions.
- To study Chemical activities taking place at muscles and neuromuscular junction.
- To study the various analysis to be done in the biofluids and different equipments used for this purpose.

UNIT I

9

CELL ENERGETICS : Cell Structure & Functions, different cell organelles and their functions - cell membrane, Structure & function

NUCLEIC ACID: Structure of Chromosome, Gene, DNA & RNA.

UNIT II

9

CARBOHYDRATES: Classification, Uses of Carbohydrates. Metabolism of carbohydrate.(Glycolysis, TCA cycle).

LIPIDS: Classification, Metabolism of lipids (Fatty acid synthesis,beta oxidation), Cholesterol, Bile acids, Transport of lipids.

PROTEIN: Classification, of Protein,Amino acids, Techniques of Chromatography, Electrophoresis and architecture of protein molecules, Ultracentrifugal separation.

UNIT III

9

ENZYMES: Chemical Nature of Enzymes, General Properties, Spectrophotometric measurement of enzymes, Isolation techniques, Diagnostic enzymes. Enzyme biotechnology.

HORMONES: Chemical Nature of Harmones, Properties of hormones, Hormonal Assay and their Significance.

UNIT IV: DIAGNOSTIC TOOL

9

Principles and Application of pectrophotometry, Colorimetry, pH meter, conductivity meter, Electron microscope, Scanning electron microscope, Microscope with digital camera. Use of Isotopes in Biochemistry. Automation in Clinical Laboratory.

UNIT V: BIO CHEMISTRY OF BLOOD AND BODY FLUIDS**9**

Liver Function tests, Renal Function Tests, Blood Analysis, Measurement of Electrolytes, Biochemistry of Urine testing.

TOTAL: 45 PERIODS**TEXT BOOK**

1. Dr. Ambiga Shanmugam, 'Fundamentals of Bio Chemistry for Medical Students', Karthic Printers, Madras 1997.
2. U Satyanarayana & U Chakrapani. Biochemistry. Swapna Printing Works. 2008.

REFERENCE

1. Robert K Murray, Daryl K Granner, Peter A Mays, Victor W Rodwell. Harper's Illustrated Biochemistry. Prited in India. 2003.
2. Tietz Fundamentals of Clinical Chemistry Carl A. Burtis, Edward R. Ashwood 5th Edition -2006

BM1271 SEMICONDUCTOR DEVICES & ELECTRONIC CIRCUITS LAB**0 1 2 2**

1. Forward and reverse characteristics of PN junction diode
2. Forward and reverse characteristics of zener diode
3. Characteristics of CE Bipolar Junction transistor
4. Characteristics of CB Bipolar Junction transistor
5. Characteristics of JFET
6. Characteristics of UJT
7. Design of RC Phase shift oscillator
8. Design of Astable multivibrator
9. Design of Schmitt Trigger
10. Clippers and clampers
11. Half wave rectifier
12. Full wave rectifier

BM1272 BIO CHEMISTRY AND HUMAN PHYSIOLOGY LAB

0 1 2 2

1. Study of Human Skeletal system and Identification of Bones
2. Study of Human Brain and identification of its parts
3. Testing of Hearing using Tuning Fork
4. Identification of (a) Carbohydrate (b) Protein (c) Amino acid
5. Estimation of Glucose in Serum
6. Estimation of Urea in Serum
7. Estimation of Total Protein in Serum
8. Estimation of Albumin in Serum
9. General Test for Proteins
10. Testing of Urine for Sugar
11. Testing of Urine for Ketone Bodies
12. Estimation of Cholesterol

BM 1273 SENSORS AND TRANSDUCERS LAB

0 1 2 2

1. Study of various Transducers
2. Characteristics of strain gauges.
3. Displacement measurement using LVDT.
4. Characteristics of temperature sensors – thermistor and RTD.
5. Characteristics of thermocouple
6. Characteristics of Flow Transducer
7. Characteristics of photo diodes, phototransistor
8. Characteristics of Piezoelectric Transducer.
9. Measurement of capacitance and inductance using bridge circuits.
10. Isolation amplifier.
11. Study of Biological Sensors

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B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER-IV

Sl. No	Course Code	Course Title	L	T	P	C
Theory						
1.	MA1206	Random Process	3	1	0	4
2.	MS1201	Environmental Science	3	0	0	3
3.	BM1206	Bio Signals and Systems	3	1	0	4
4.	BM1207	Integrated Circuits	3	1	0	4
5.	BM1208	Pathology and Microbiology	3	0	0	3
6.	BM1209	Basics of Electrical Engineering	3	1	0	4
Practical						
7.	BM1274	Integrated Circuits Lab	0	1	2	2
8.	BM1275	Pathology and Microbiology Lab	0	1	2	2
9.	BM1276	Electrical Engineering Lab	0	1	2	2
TOTAL			18	7	6	28

AIM:

The probabilistic models are applicable in all areas of Science and Engineering. This course provides necessary mathematical support to solve real life problems.

OBJECTIVE:

To have the fundamental knowledge of basic probability concepts, the standard distributions, the classification of processes and spectral density which can describe real life phenomena.

UNIT I PROBABILITY AND RANDOM VARIABLE 9

Axioms of probability - Conditional probability – Independent Events - Total probability – Baye’s theorem- Random variable - Probability mass functions - Probability density functions -Distribution functions- Properties – Expectation – Moments - Moment generating function and its propertie.

UNIT II STANDARD DISTRIBUTIONS 9

Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties (Problems only)– Central Limit Theorem.(without proof)

UNIT III TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions - Marginal and Conditional distributions – Covariance - Correlation and Regression.

UNIT IV CLASSIFICATION OF RANDOM PROCESSES 9

Definition and Examples - first order, second order, strictly stationary, wide – sense stationary and Ergodic processes - Markov process - Binomial, Poisson and Gaussian processes - Sine wave process.

UNIT V CORRELATION AND SPECTRAL DENSITIES 9

Auto Correlation - Cross Correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function - Linear time invariant system - System transfer function –Linear systems with random inputs – Auto correlation and cross correlation functions of input and output – Fundamental theorem of power spectral density.

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

TEXT BOOKS:

1. Ross, S., “A First Course in Probability”, Fifth edition, Pearson Education, Delhi, 2002 (Chapters 2 to 8)
2. Peebles Jr. P.Z., “Probability Random Variables and Random Signal Principles”, Tata McGraw-Hill Publishers, Fourth Edition, New Delhi, 2002, (Chapters 6, 7 and 8).

REFERENCES:

1. Henry Stark and John W. Woods “Probability and Random Processes with Applications to Signal Processing”, Pearson Education, Third edition, Delhi, 2002.
2. Veerarajan. T., “Probability, Statistics and Random Processes”, Tata McGraw-Hill Publications, Second Edition, New Delhi, 2002.
3. Ochi, M.K. , “Applied Probability and Stochastic Processes”, John Wiley & Sons, New York, 1990.
4. Douglas C. Montgomery and George C. Runger, “Applied Statistics and Probability for Engineers”, 3rd Edition , John Wiley & Sons (2004)

MS1201

ENVIRONMENTAL SCIENCE

3 0 0 3

OBJECTIVES

- To provide the students about general aspirants of environment and ecology, the environment pollution and the current social issues.

UNIT I: NATURE OF ENVIRONMENT STUDIES AND NATURAL RESOURCES

9

Environment studies- definition- multi disciplinary nature – scope and importance- need for public awareness- Natural resources- Forest resources- energy resources- food Resources- water resources – land resources - mineral resources.

UNIT II: ECO SYSTEMS AND BIO-DIVERSITY

9

Concept and component of eco systems- producer, consumer, decomposer- structure and function of eco system- food chain and food web- energy flow model- aquatic eco system- forest eco system- desert eco system- pyramid of biomass- ocean eco system- grass land eco system- Bio diversity in India- value of bio diversity- biodiversity threatens- biodiversity protection- In-situ and Ex-situ conservation.

UNIT III: ENVIRONMENTAL POLLUTION

9

Meaning of environmental pollution- air pollution- acid rain – global warming- water pollution- water pollution control- soil pollution- urban waste and soil pollution- marine pollution- noise pollution- thermal pollution- solid and hazardous waste management- waste disposal methods- solid waste and India- natural disaster and disaster management. Low carbon perspectives, Energy savings, Safety and Security

UNIT IV: SOCIAL ISSUES AND THE ENVIRONMENT

9

Unsustainable to sustainable development- sustainable development in India- water conservation, watershed management and water harvesting- environmental ethics- role of engineer in environmental protection- economic aspects of environment.

UNIT V: HUMAN POPULATION AND ENVIRONMENT

9

Population growth- distribution of population- factors affecting variation in population- theories of population- future of human population- family welfare programme- HIV and

AIDS- environment and human health- human rights- value education- women and child welfare.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cunnigham & saigo: 'Environmental science :A global concern' 4th Ed.W.c. Brown Publishers. USA. 1997
2. Chauhan A.S, 'Environmental studies' 2nd revised ed.2004, Jain Brother publishers, New Delhi

REFERENCE BOOKS

1. Benny Joseph : 'Environmental Science and Engineering', 2006, Tata McGraw- Hill Publication.
2. Siddique K.A. : Elements of Ecology and Environmental Pollution, 1st Ed. 2002, Kushal Publication, Varanasi.

BM1206

BIO SIGNALS AND SYSTEMS

3 1 0 4

AIM

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

OBJECTIVES

- To study the properties and representation of discrete and continuous signals.
- To study the sampling process and analysis of discrete systems using z-transforms.
- To study the analysis and synthesis of discrete time systems.
- To study the analysis of Biosignals

1. CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Continuous time signals (CT signals), Discrete time signals (DT signals)- Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals- Periodic and Aperiodic, random signals, CT systems and DT systems, Classification of systems - Linear Time invariant systems.

2. ANALYSIS OF CT SIGNALS 9

Fourier series analysis, Spectrum of CT signals, Fourier Transform and Laplace Transform in Signal Analysis.

3. LTI - CT SYSTEMS 9

Differential equation, Block diagram representation, Impulse response, Convolution integral, Frequency response, Fourier Methods and Laplace transforms in analysis

4. ANALYSIS OF DT SIGNALS 9

Spectrum of DT signals, Discrete Time Fourier Transform (DTFT), Properties of Z-transform in signal analysis.

5. LTI - DT SYSTEMS & BIO SIGNALS

9

Difference equations, Block diagram representation, Impulse response, Convolution SUM, Frequency response, FFT and Z-transform analysis, Biosignal & its analysis

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

TEXT BOOK

1. Allan V. Oppenheim et al, "Signals and Systems", Prentice Hall of India Pvt. Ltd, 1997.

REFERENCES

1. Ashok Ambardar, "Analog and Digital Signal Processing", Thomson Learning Inc., 1999.
2. Douglas K.Lindner, "Signals and Systems", McGraw-Hill International, 1999.
3. Simon Haykin and Barry Van Veen, "Signals and Systems", John Willey & Sons, Inc, 1999.
4. Roger E. Zeimer et al, "Signals and Systems", Continuous and Discrete, McMillan, 2 ED, 1990.

BM1207

INTEGRATED CIRCUITS

3 1 0 4

AIM

To teach the basic concepts in the design of electronic circuits using linear integrated circuits and their applications in the processing of analog signals.

OBJECTIVES

- To introduce the basic building blocks of integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To teach the theory of ADC and DAC

UNIT I: INTRODUCTION

9

Integrated Circuits : Classification, chip size and circuit complexity, Fundamentals of Monolithic IC technology, basic planar processes, Fabrication of a typical circuit, Active and passive components of ICs, fabrication of FET, Thin and thick film technology.

Operation Amplifier: basic information of Op-amp, ideal and practical Op-amp, Op-amp characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential mode.

UNIT II: OP-AMP APPLICATIONS

9

Basic application of Op-amp, instrumentation amplifier, ac amplifier, V to I and I to V converters, Precision rectifiers, log and antilog amplifiers, sample & hold circuits, multipliers and dividers, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrator, Triangular wave generator.

UNIT III: ACTIVE FILTERS, OSCILLATORS AND REGULATORS 9

Introduction-Low pass and High pass filters- Design of first and second order Butterworth lowpass and high pass filters Band pass, Band reject and all pass filters- Oscillator types and principle of operation – RC, Wien bridge oscillators triangular, saw-tooth, square wave and VCO- Introduction to voltage regulators, features of 723, Three Terminal IC regulators- DC to DC Converter- Switching Regulators-UPS-SMPS.

UNIT IV: TIMERS & PHASE LOCKED LOOPS 9

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Schmitt Trigger. PLL - introduction, block schematic, principles and description of individual blocks of 565-PLL applications, Analog and digital phase detectors.

UNIT V: D-A AND A- D CONVERTERS 9

Introduction, basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC, dual slope ADC and Sigma delta ADC. DAC and ADC specifications. DAC 0800 and ADC 0804 pin diagram and applications.

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

TEXT BOOK

1. Sergio Franco, 'Design with operational amplifiers and analog integrated circuits', McGraw-Hill, 1997.
2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.

REFERENCES

1. Gray and Meyer, 'Analysis and Design of Analog Integrated Circuits', Wiley International, 1995.
2. J.Michael Jacob, 'Applications and Design with Analog Integrated Circuits', Prentice Hall of India, 1996.
3. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall / Pearson Education, 1994.
4. K.R.Botkar, 'Integrated Circuits'. Khanna Publishers, 1996.
5. Taub and Schilling, Digital Integrated Electronics, McGraw-Hill, 1997.
6. Millman.J. and Halkias.C.C. 'Integrated Electronics', McGraw-Hill, 1972.
7. William D.Stanely, 'Operational Amplifiers with Linear Integrated Circuits'. Pearson Education, 2004.

BM1208 PATHOLOGY AND MICROBIOLOGY

3 0 0 3

UNIT I: 9

History and Scope of Pathology & Microbiology – General Structural Organisation of bacterial and viral cell and fungal cell - Classification of bacteria, Virus, Fungi.

UNIT II: **9**
Haematology - Different kinds of blood cells – structure and function, Fluid and hemodynamic derangements, - edema, normal hemostasis, thrombosis, disseminated intravascular coagulation, embolism, infarction, shock. Hematological disorders- Bleeding disorders, Leukaemias, Lymphomas.

UNIT III : **9**
Viral disease - AIDS, Influenza, Dengue and Chikenguniya - **Bacterial disease** - Typhoid and Pneumonia - **Fungal disease** - Skin disease and ear disease.

UNIT IV: **9**
Culture media, Antibacterial activity - Identification of disease producing organisms, simple stain, Gram stain, AFB stain, Fluorescent techniques, antigen-antibody techniques, microbial biosensors.

UNIT V: **9**
Genetic disorders, Infection and Immunity- Mutations, Autosomal and X linked disorders, Mendelian disorders, types of immune response, hypersensitivity disorders, Immune deficiency syndrome, Viral disease, Chlamydial, Bacterial, Mycoplasma, Rickettsial, Fungal, protozoal and helminthic disease.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ramzi S Cotran, Vinay Kumar & Stanley L Robbins: Pathologic Basis of diseases. WB Saunders Co. 7th edn-2005.
2. Harsh Mohan: Text book of Pathology. Jaypee publishers. 4th edn. 2000.
3. Ananthanarayanan R & Panicker CKJ: Textbook of Microbiology. Orient Longmans. 7th ed. 2006.
4. Dubey RC and Maheswari DK. A textbook of Microbiology. S Chand 2007.

REFERENCE:

1. Underwood JCE: General and Systematic Pathology Churchill Livingstone 3^{edn}. 2000.
2. Prescott, Harley, Klein. Microbiology. Mc Graw Hill 5th ed. 2002.
3. Manual of Microbiology tools and techniques. Kanika Sharma. Ane's student edition. 2007.

BM1209 **BASICS OF ELECTRICAL ENGINEERING** **3 1 0 4**

AIM

To know about basic of the various concepts in Electrical engineering

OBJECTIVES

- To study about various network theorems and the method of application to analyse a circuit.
- To study about Constructional details, principle of operation of D.C. machines.
- To study about Constructional details, principle of operation of transformers and induction motors.

- To study about Constructional details and principle of operation of alternators and special machines

UNIT 1 BASICS OF CIRCUIT ANALYSIS: 9

Kirchhoff's laws- network reduction techniques- series, parallel, series parallel circuits. Review of fundamentals of AC circuits, inductance and capacitance parameters, Concept of Reactance, Impedance, Susceptance and Admittance, Steady state analysis of R, L and C (in series, parallel and series parallel combinations) with sinusoidal excitation- power factor, Real and Reactive powers, Complex and Polar forms of representation, Complex power. Definitions – Graph – Tree, Basic cut-set and Basic Tie-set matrices for planar networks – Loop - Duality & Dual networks.

UNIT II NETWORK THEOREMS 9

Review of loop and nodal methods of analysis, star-to-delta or delta-to-star transformation, Source transformation Superposition theorem, Thevenin's theorem, Norton's theorem, reciprocity theorem, compensation theorem, Maximum power transfer theorem, Millman's theorem and Tellegen's theorem.

UNIT III : DC MACHINES 9

Constructional details – emf equation – Methods of excitation – Self and separately excited generators – Characteristics of series, shunt and compound generators – Principle of operation of D.C. motor – Back emf and torque equation – Characteristics of series, shunt and compound motors - Starting of D.C. motors

UNIT IV : AC MACHINES 9

Transformers : Principles of Operation and characteristics of Transformers (Single – Phase and Three – Phase), emf equation – Transformation ratio Induction Motors: Construction – Types – Principle of operation of Single-phase induction motors , three-phase induction motors

UNIT V : SPECIAL MACHINES 9

Brushless alternators – Reluctance motor – Hysteresis motor – Stepper motor Principle of operation, types, Servo Motor.

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

TEXT BOOKS

1. A Sudhakar, Shyammohan S. Palli, "Circuits and Networks Analysis and Synthesis", Second Edition, Tata McGraw-Hill, 2002.
2. B L Theraja and A K Theraja, "A Textbook of Electrical Technology " ,Rev. Edn. 2007 edition, S Chand Publications

REFERENCES

1. Vasudev. K. Aartre, "Network Theory and Filter Design", Wiley – Eastern Ltd, Second Edition, 1993.
2. Miller, T.J.E. "Brushless permanent magnet and reluctance motor drives ", Clarendon Press, Oxford, 1989.

BM1274**INTEGRATED CIRCUITS LAB****0 1 2 2**

1. Inverting, Non inverting and Differential amplifiers using IC 741.
2. OP AMP Applications – Adder, Subtractor, Integrator and Differentiator Circuits using IC 741.
3. Integrator and Differentiator using IC 741.
4. Multiplexer & Demultiplexer using IC 741.
5. Schmitt Trigger using IC 741.
6. Instrumentation Amplifier using IC 741.
7. Active Filter Applications – LPF, HPF (first order)
8. IC 741 Oscillator Circuits – Phase Shift and Wien Bridge Oscillators.
9. Function Generator using OP AMPs.
10. IC 555 Timers – Monostable and Astable Operation Circuit.
11. Voltage Regulator using IC 723.
12. 4 bit DAC using OP AMP.

BM1275**PATHOLOGY AND MICROBIOLOGY LAB****0 1 2 2**

1. Study of Microscope
2. Determination of Blood group
3. Haemoglobin Estimation.
4. Bleeding time and clotting time
5. Blood film making & identification of different blood corpuscles
6. Measurement of total leucocytes in Blood
7. Peripheral Smear Study.
8. Determination of Erythrocyte sedimentation rate
9. Urine physical and chemical Examination
10. Cross matching of Blood.
11. Study of Tissue Biopsy – Benign and Malignant.
12. Simple Stain test
13. Gram Stain test.
14. AFB Stain test.

1. Verification of Kirchoff's Laws
2. Verification of Thevenin's Theorem
3. Verification of Norton's Theorem
4. Verification of Superposition Theorem
5. Verification of Reciprocity Theorem
6. Verification of Maximum power transfer theorem
7. Verification of Compensation theorem
8. Open circuit and load characteristics of separately and self excited DC shunt generators.
9. Load characteristics of DC shunt motor.
10. Load characteristics of DC series motor.
11. Load test on single-phase transformer.
12. Load test on Single-phase induction motors

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B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER-V

<i>Sl. No</i>	<i>Course Code</i>	<i>Course Title</i>	L	T	P	C
THEORY						
1.	MS1202	Professional and Business Ethics	3	0	0	3
2	BM1210	Biomedical Instrumentation and Measurements	3	0	0	3
3.	BM1211	Bio-Signal Processing	3	1	0	4
4.	BM1212	Digital Electronics and Processors	3	1	0	4
5.	BM1213	Bio Control system	3	1	0	4
6.	BM1214	Diagnostic and Therapeutic Equipments	3	0	0	3
PRACTICALS						
7.	BM1277	Digital Electronics and Microprocessor Lab	0	1	2	2
8.	BM1278	Bio-Signal Processing Lab	0	1	2	2
9.	BM1279	Biomedical Instrumentation Lab	0	1	2	2
TOTAL			18	6	6	27

OBJECTIVES

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty
- To appreciate the rights of Others.

UNIT I: HUMAN VALUES**9**

Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.

UNIT II: ENGINEERING ETHICS**9**

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION**9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study

UNIT IV: SAFETY, RESPONSIBILITIES AND RIGHTS**9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime -Professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

UNIT V: GLOBAL ISSUES**9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - oral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.

TOTAL: 45 PERIODS**TEXT BOOKS**

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

REFERENCES

1. Charles D. Fleddermann, “Engineering Ethics”, Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).

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

BM1210 BIOMEDICAL INSTRUMENTATION AND MEASUREMENTS 3 0 0 3

UNIT I ELECTROPHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

The origin of Bio-potentials, electrodes, Biological amplifiers, ECG, EEG, EMG, PCG, EOG, lead system and recording methods, typical waveforms and signal characteristics.

UNIT II INTRODUCTION TO BIOMEDICAL INSTRUMENTATION 9

Fundamentals of biomedical Instrumentation – Performance requirement – General constraints in design. Recording Systems: Basic recording system, Electrode electrolyte interface, half-cell potential, polarization and non-polarizable electrode, needle and wire electrode.

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 PARAMETER 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

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", Prentice hall of India, New Delhi, 1997.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 1997.

REFERENCES:

1. John G. Webster, "Medical Instrumentation Application and Design", John Wiley and sons, New York, 1998.
2. Joseph J.carr and John M. Brown, "introduction to Biomedical equipment technology", John Wiley and sons, New York, 1997.

BM1211**BIO SIGNAL PROCESSING****3 1 0 4****UNIT I****BIO SIGNALS****9**

Simple signal conversion systems – conversion requirement for biomedical signals – signal conversion circuits. Discrete Fourier Transform (DFT) – Properties – circular and sectioned convolution – Filtering long duration sequences - FFT computation using DIT and DIF algorithms.

UNIT II**FILTER DESIGN****9**

FIR design: Windowing techniques – Need and choice of Windows – Linear phase characteristics. IIR design: Analog filter design – Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation – Warping, prewarping – Frequency transformation.

UNIT III**NOISE CANCELLATION****9**

Adaptive filters – Principle noise canceller model – 50 Hz adaptive cancelling using a sine wave model – Maternal ECG cancellation in fetal electrocardiography – ECG cancellation in EMG recording – High frequency noise cancellation in Electro surgery. Signal averaging – Basics and limitations.

UNIT IV**BIO SIGNALS ANALYSIS****9**

EEG signal characteristics – EEG analysis - time and frequency domain methods parametric model – Phenomenological model – linear prediction theory – Autoregressive method.

UNIT V**SIGNAL PROCESSING****9**

ECG QRS detection Techniques – Estimation of R-R interval – Estimation of ST segment inclination – Arrhythmia analysis monitoring – Long term ECG recording – Basics of ECG data reduction techniques.

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

1. DC Reddy, Biomedical Signal Processing – Principles and Techniques, Tata McGraw Hill Publishing company Ltd., 2005 (UNITS III,IV & V)
2. P.Ramesh Babu, "Digital Signal Processing", Second Edition, Scitech publications, Chennai, 2003 (UNITS I & II)

REFERENCES:

1. Willis J.Tompkins, Biomedical Digital signal processing, Prentice Hall of India Pvt. Ltd., 2000
2. Biomedical Signal Analysis A case study approach by Rangaraj M.Rangayyan, John Wiley publications.

BM1212 DIGITAL ELECTRONICS AND PROCESSORS 3 1 0 4

UNIT I COMBINATIONAL LOGIC CIRCUITS 9

Review of number systems - Logic gates: NAND, NOR gate as universal building blocks - Simplification of four-variable Boolean equations using Karnaugh maps - Half adder, Full adder, Half subtractor, Full subtractor - 4-bit parallel adder and subtractor - 3-bit binary decoder - Decimal to BCD encoder – 8-to-1 multiplexer, 1-to-8 Demultiplexer

UNIT II SEQUENTIAL LOGIC CIRCUITS 9

Flip-flops: SR flip-flop, Edge-triggered flip-flops (SR,D,JK and T), Master-slave JK flip-flop - 4-bit binary asynchronous and synchronous counter - Decade counter (asynchronous and synchronous) - Shift registers (SISO,SIPO,PISO,PIPO) - Ring counter – Memories (RAM, ROM, EPROM, FLASH)

UNIT II D/A AND A/D CONVERTERS 9

Ladder type D/A converter - Dual slope A/D converter - Successive approximation A/D converter - Study of DAC0800 and ADC0809 chips

UNIT IV 8086 MICROPROCESSOR 9

Pin diagram - CPU architecture - Memory segmentation - Internal operations - Addressing modes - Instruction formats - Assembler instruction formats: Data transfer instructions, Arithmetic instructions, Logical instructions, Branch-and-loop instructions – Interrupts: Software and Hardware interrupts, Software interrupt programming

UNIT V PERIPHERAL CHIPS 9

8255 (PPI), 8254 (Timer), 8257 (DMA), 8259 (PIC), 8251 (USART)

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

TEXT BOOKS:

1. Thomas L Floyd, Digital Fundamentals, Universal Books, , New Delhi
2. Douglas V. Hall, Microprocessors and Interfacing, TMH

REFERENCES:

1. Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family, PHI
2. Barry B. Brey, Microprocessors and Peripherals, CBS Publishers & Distributors, Delhi
3. R.K. Gaur, Digital Electronics and Microcomputers

BM1213

BIO CONTROL SYSTEMS

3 1 0 4

UNIT I INTRODUCTION 9

Technological control system, transfer function, mathematical approaches, system stability, introduction to biological control system, Modeling and block diagram, closed loop dynamics of first order and second order control system, similarities between biological and engineering control system, biological receptors and receptor characteristics.

UNIT II PROCESS REGULATION 9

Acid-base balance, extra-cellular water and electrolyte, interstitial fluid volume, blood pressure, blood glucose, CO₂.

UNIT III MODELING OF HUMAN THERMAL REGULATORY SYSTEM 9

Parameters involved, control system model etc. Biochemistry of digestion, types of heat loss from body, models of heat transfer between subsystems of human body like skin - core etc. and systems like within body, body environment.

UNIT IV BIOLOGICAL CONTROL I 9

Cardiac rate, blood pressure, respiratory rate, mass balancing of lungs, oxygen uptake by RBC and pulmonary capillaries, oxygen and carbon dioxide transport in blood and tissues.

UNIT V BIOLOGICAL CONTROL II 9

Urine formation and control, Pupil control systems, skeletal muscle servomechanism, and semicircular canal. Free swinging limbs, Endocrine control system.

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

TEXT BOOKS

1. Sujit K. Chaudhuri – Concise Medical Physiology – New Central Book agency, 1997 (UNITS II, III, IV & V)
2. Modern control engineering. Ogata Katsuhika. 2nd edition, Prentice Hall of India (UNIT I)

REFERENCE BOOKS:

1. Barry R. Dworkin, Learning and Physiological Regulation (Hardcover), University Of Chicago Press, March 1993.
2. E. Carson, E. Salzsieder, Modelling and Control in Biomedical Systems 2000 (including Biological Systems) (IFAC Proceedings Volumes) (Paperback), Pergamon Publishing, January 2001.

UNIT I ULTRASONIC AND SENSORY MEASUREMENT TECHNIQUE 9

Diagnosis: Basic principles of Echo technique, display techniques A, B and M mode, Application of ultrasound as diagnostic tool – Echocardiogram, abdomen, obstetrics and gynecology, ophthalmology - Psycho Physiological Measurements-for testing and sensory Responses, Electro occluso graph, Electro radiograph, Audiometer-Pure tone, Speech. EGG (Electro gastro graph), galvanic skin resistance (GSR).

UNIT II CARDIAC EQUIPMENTS 9

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

UNIT III DIATHERMY 9

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

UNIT IV NEUROLOGICAL EQUIPMENTS AND SKELETAL MUSCULAR SYSTEM 9

Clinical significance of EEG, Multi channel EEG recording system, Epilepsy, Evoked Potential –Visual, Auditory and Somatosensory, MEG (Magneto Encephalon Graph).EEG Bio Feedback Instrumentation. Sliding theory of contraction, recording and analysis of EMG waveforms, fatigue characteristics, Muscle stimulators, nerve stimulators, Nerve conduction velocity measurement, EMG Bio Feedback Instrumentation.

UNIT V RESPIRATORY MEASUREMENT SYSTEM 9

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

TOTAL: 45 PERIODS

TEXT BOOK:

1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997. (UNIT III – Chapters 21; UNIT V – Chapters 6, 9)
2. John G. Webster, Medical Instrumentation: Application and Design, Wiley; 3 edition, August 1997 (UNITS I, II & IV)

REFERENCE:

1. Joseph J.carr and John M. Brown, “Introduction to Biomedical equipment technology”, John Wiley and sons, New York, 1997.

OBJECTIVES

- To understand logic gates and circuits
- To design sequential and combinational circuits
- To program microprocessors for simple math functions
- To program microprocessors for data sorting and moving
- To design interfaces

I. DIGITAL ELECTRONICS

1. Study of Logic Gates
 - Logic gates using discrete components
 - Verification of truth table for AND, OR, NOT, NAND, NOR and XOR gates
 - Realization of NAND and NOR gates
2. Implementation of Logic Circuits
 - Verification of Boolean laws
 - Verification of DeMorgan's law
3. Adder and Subtractor
 - Implementation of Half-Adder and Full-Adder
 - Implementation of Half-Subtractor and Full-Subtractor
4. Combinational Circuit Design
 - Design of Decoder and Encoder
 - Design of Code Converter
 - Design of multiplexers and de multiplexers
5. Sequential Circuit Design
 - Implementation of Shift registers, Serial Transfer
 - Ring Counter
 - 4-bit Binary Counter
 - BCD Counter

II. MICROPROCESSORS

6. Programs for 8/16 bit Arithmetic operations (Using 8085, 8086)
7. Programs for 16 bit Arithmetic, Sorting, Searching and String operations (Using 8085, 8086).
8. Programs for String manipulation operations (Using 8086).
9. Programming using Arithmetic, Logical and Bit Manipulation instructions of 8051 microcontroller.
10. Programming and verifying Timer, Interrupts and UART operations in 8051 microcontroller.

TOTAL: 45 PERIODS

BM1278

BIO SIGNAL PROCESSING LAB

0 1 2 2

AIM:

- ECG processing and pattern recognition
- EEG analysis and modeling.
- EEG analysis – Rhythm detection
- ECG analysis - Smoothing filters
- QRS detection

OBJECTIVES:

- The course should impart the basic concepts of signal processing applied to various biosignals so as to analyze them.
 - The major areas of biomedical engineering include Medical instrumentation, Biosensors and signal Rehabilitation engineering, Medical image processing etc. All these areas need strong basics in various biosignals, their characteristics, processing and analysis, which would be offered by this course on BSP.
1. Sine wave generation using MATLAB.
 2. Generation of AM, FM & PWM waveforms using MATLAB.
 3. Computation of convolution and correlation sequence using MATLAB.
 4. Analog and digital signal conditioning
 5. Discrete Fourier Transform: (Unfolding the spectrum, Frequency Unwrapping) using MATLAB
 6. Design & implementation of IIR filters. (Butterworth and Chebyshev Filters) using MATLAB
 7. Design & implementation of FIR filters. (Window method and Frequency sampling Method) using MATLAB
 8. Implementation of FFT for ECG Signal using MATLAB
 9. Spectrum analysis & Noise removal of biomedical signals
 10. Design of Notch filter for elimination of 50 Hz from ECG signal.
 11. EMG Processing using MATLAB – Rectification and Signal averaging.
 12. PC based ECG analyser.
 13. EMG processing using MATLAB –Rectification and Signal Averaging
 14. ECG data reduction algorithms
 15. Down sampling & up-sampling of ECG signal.

TOTAL: 45 PERIODS

BM1279

BIOMEDICAL INSTRUMENTATION LAB

0 1 2 2

1. Recording of ECG signal and Analysis.
2. Recording of EMG and Analysis.
3. Recording of EEG and Analysis.
4. Patient Monitoring System and Telemetry Units.
5. Measurement of pH, pO₂ and conductivity.

6. Study of Diathermy.
7. Study of spectroscopy.
8. Study of Nebulizer.
9. Study of Baby Ventilator.
10. Study of Dialysis.
11. Study of Fluoroscopy.

TOTAL: 45 PERIODS

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

NOORUL ISLAM UNIVERSITY, KUMARACOIL

B.E. BIOMEDICAL ENGINEERING

CURRICULUM & SYLLABUS

SEMESTER-VI

Sl. No	Course Code	Course Title	L	T	P	C
Theory						
1.	IT1212	Cyber Security	3	0	0	3
2.	BM1215	Medical Image Processing	3	0	0	3
3.	BM1216	Communication Engineering and Networking	3	1	0	4
4.	BM1217	Medical Imaging Techniques	3	0	0	3
5.	Xxx2E1	Elective - I	3	0	0	3
6.	Xxx2E2	Elective – II	3	0	0	3
Practical						
7.	BM1280	Medical Image Processing Lab	0	1	2	2
8.	BM1281	Medical Imaging Equipments Lab	0	1	2	2
9.	BM1282	Biomedical Engineering Lab	0	1	2	2
TOTAL			18	4	6	25

AIM

The Course curriculum aims at imparting the fundamentals of cyber crime investigation, the tools used for the investigation, in addition to giving an exposure to the various kinds of cyber security threats and their impact on connected systems/resources.

OBJECTIVES

- The course also gives an exposure to the different types of mechanisms to sanitize the cyber space by adopting standardized operating procedures while transacting business/commerce online, and also to ensure security of information handled over the net.
- Introduction to the Cyber Laws and the IPC/Cr.PC equips the students with sufficient legal knowledge about deterrence in preventing cyber crimes.

UNIT I COMPUTER ORGANIZATION & ARCHITECTURE AND OPERATING SYSTEMS 6

Computer Organization, Architecture, Operating Systems, Process Management, CPU Scheduling, I/O Memory Management, file systems and deadlocks. LAN, MAN, WAN, ISO/OSI seven layer architecture.

UNIT II INFORMATION SECURITY FUNDAMENTALS 6

Background, Importance, statistics, national and international scenarios. Identification and authentication, confidentiality, privacy, integrity, non-repudiation. Goals of security: prevention, detection and recovery. E-commerce security. Critical Infrastructure Protection.

UNIT III SECURITY THREATS AND VULNERABILITIES 9

Overview of security threats, various kinds of threats; Authentication-weak passwords. Insecure internet connection- internet cookies, viruses and other infections. Security of hard drives, security of laptops; sniffers, backdoors and Trojans. Buffer overflow and other programming bugs. Common attacks- DoS, man-in-the-middle, brute force attacks

UNIT IV OVERVIEW OF SECURITY PRINCIPLES 15

Security policies and procedures, International standards, Security consideration of OS- OS hardening - Internet protocols and security: SSL/TLS, IP Security, Application layer security - Access Control: Physical, Logical and Biometric - Tools and Techniques: Firewalls, Antivirus, IDS, Log analysis, Cryptography, steganography - Security Infrastructure: PKI, VPN, Digital signature - Network scanners, vulnerability scanners - Device Security - Cloud computing security, Database security.

UNIT V CYBER CRIMES. 9

Cyber crimes, Cyber crime Investigation, and Cyber forensic tools. Cyber Laws. Information Technology Act, Cyber laws and cyber crime investigation. Social networks and analysis.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas Calabres and Tom Calabrese, “Information Security Intelligence: Cryptographic Principles & Application”, Thomson Delmar Learning, 2004.
2. Bernadette H Schell, Clemens Martin, “Cyber Crime”, ABC-CLIO Inc, California, 2004.
3. Swiderski, Frank and Syndex, “Threat Modeling”, Microsoft Press, 2004.
4. William Stallings and Lawrie Brown, “Computer Security: Principles and Practice”, Prentice Hall, 2008.

REFERENCES

1. Silberschatz A, Galvin P, Gagne G, "Operating Systems Concepts", John Wiley & Sons, Singapore, 2006.
2. Principles and Practices of Information Security by Michael.E. Whiteman and Herbert .J. Mattord.
3. Cyber Laws by Aparna Viswanathan.
4. Joseph M Kizza, “Computer Network Security”, Springer Verlag, 2005.

BM1215

MEDICAL IMAGE PROCESSING

3 0 0 3

UNIT I

DIGITAL IMAGE FUNDAMENTALS

9

Examples of fields that use digital image processing, Fundamental steps in digital image processing, components of an image processing system, Applications of Digital image processing. Light and Electromagnetic spectrum , Image sensing and acquisition, image acquisition using sensors strips, image acquisition using sensors arrays, a simple image formation model, image sampling and quantization, representing digital images, basic relationships between pixels.

UNIT II

IMAGE TYPES AND IMAGE FILE FORMATS

9

Image Types- Binary images, Gray scale images, Color image, Volume image, Range image, Multispectral image, Volumetric Data, X-Ray images, CT images, MRI images. f-MRI images Image file formats – GIF file format, JPEG, PNG, TIFF, BMP.

UNIT III

INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING

9

Basics of Intensity transformation and spatial filtering, Basic intensity transformation functions, Piecewise-Linear Transformation functions, histogram processing- histogram equalization, histogram matching, enhancement using arithmetic and logic operators, basis spatial filtering, smoothing and sharpening spatial filters, combining the spatial enhancement methods.

UNIT IV

IMAGE RESTORATION

9

A model of the image degradation/restoration process, noise models, restoration in the presence of noise-only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms ; Introduction to the Fourier transform and the frequency domain, estimating the degradation function.

TCP/IP Model, Protocols and Standard, Packet switching, circuit switching, Throughput, bandwidth, level of service parameters

UNIT-V ROUTING AND CONGESTION CONTROL ALGORITHMS 9

Error detection and correction Flooding; Minimal spanning trees; Bellman Ford, Dijkstra's, OSPF, BGP shortest path algorithms; the leaky bucket, Floyd Warshall and Random Early Detection congestion methods

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

TEXT BOOKS

1. Wayne Tomasi, 'Electronic Communication Systems', Pearson Education, 3rd Edition, 2001.
2. Simon Haykins, Communication systems, John Wiley, 4th Edition, 2001.
3. Data Communications and Networking by Behrouz A Forouzan, Tata Mc-graw hill, 2007.

REFERENCES BOOKS

1. William Schweber, 'Electronic Communication Systems', Prentice Hall of India, 2002.
2. G. Kennedy, 'Electronic Communication Systems', McGraw Hill, 4th edition, 2002.
3. Miller, 'Modern Electronic Communication', Prentice Hall of India, 2003
4. Roy Blake, 'Electronic Communication Systems', Thomson Delmar, 2nd Edition, 2002
5. Data and Computer Communications by W. Stallings, Prentice Hall, 2005.
6. Computer Networks by A.S. Tanenbaum, Prentice Hall, 2005.

BM1217 MEDICAL IMAGING TECHNIQUES 3 0 0 3

UNIT – I DIFFERENT MODES OF MEDICAL RECORDING 9

Quality assurance and image improvement in diagnostic radiology with X-Rays, specific Quality assurance tests for X-rays, need for sectional images, principles of sectional images recording, computer tomography. Mammographic X-Rays Equipment, Fluoroscopy.

UNIT – II RADIOISOTOPIC IMAGES 9

Radio isotopic imaging equipments, radiation detectors, radionuclide for imaging, static and dynamic planar scintigraphy. Gamma Camera – Emission Computed Tomography – Single – Photon Emission Computed Tomography – Positron Emission Tomography – System Components Of Computer Tomography - Patient Dose In CT Scanners.

UNIT – III NUCLEAR MAGNETIC RESONANCE IMAGING 9

Principles Of NMR Imaging Systems - Image Reconstruction Techniques – NMR Components – Biological Effects Of NMR Imaging - Advantages Of NMR Imaging System. Development of NMR, relaxation processes and their measurements, MRI-Image acquisition and reconstruction, MRI safety

UNIT – IV MATHEMATICS OF IMAGE FORMATION AND IMAGE PROCESSING 9

Concept of object and image, general image processing problem, discrete fourier representation and models for imaging, image restoration, image sampling, perception of moving images. – Image reconstruction in computed tomography and MRI.

UNIT – V COMPUTER REQUIREMENT FOR IMAGING SYSTEM 9

Image enhancement - Single/ multi user system, transferring of images, processing speed, display of medical images, pixel intensity calculation - 3-D image display and its clinical applications. 3D modeling of display image.

TOTAL: 45 PERIODS

TEXT BOOK

1. K.kirk shung, Michael b.smith and Benjamin tsui “ Principles Of Medical Imaging” san Diego, California

REFERENCES

1. Steve Webb, “The physics of medical imaging”, Adam Hilger, Bristol, England, Philadelphia, USA, 1988.
2. Paul Suetens - “Fundamentals Of Medical Imaging”, Cambridge Medicine

BM1280 MEDICAL IMAGE PROCESSING LAB 0 1 2 2

1. Application of circular convolution.
2. Circular correlation between two signals.
3. Gray level Transformation-Image negatives,
4. Image subtraction of Medical Images (CT & MRI)
5. Contrast Enhancement of medical images
6. Histogram techniques applied to X-Ray , CT and PET images.
7. Filtering- Low pass and High pass filters for CT and MRI Images.
8. Perform the wiener filter of the given image.
9. Perform the inverse filter of the given image.
10. Edge detection using different edge detectors.

TOTAL: 45 PERIODS

BM1281 MEDICAL IMAGING EQUIPMENTS LAB 0 1 2 2

1. Study of Dental X-Ray Imaging
2. Study of Mammography imaging
3. Study of Thermography Imaging
4. Study of SPECT imaging
5. Study of PET imaging
6. Study of MRI imaging
7. Study of CT imaging
8. Study the importance of gamma camera in Imaging
9. Study of detectors used in Imaging Equipments
10. Study of ultra sound imaging system

11. Study of dormitory

TOTAL: 45 PERIODS

BM1282

BIOMEDICAL ENGINEERING LAB

0 1 2 2

1. Shortwave and ultrasonic diathermy.
2. Study of Computerized Tomography.
3. Leakage current and electrical safety measurements.
4. Study of X-Ray unit.
5. Study of ultrasonic transducers and displays.
6. Study of Pulse Oxymeter.
7. Study of CATH LAB setup
8. Measurement of galvanic skin resistance.
9. Measurement of heart sound using Electronic Stethoscope.
10. Determination pulmonary function using Spirometer (using mechanical system).

TOTAL: 45 PERIODS

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NOORULISLAMUNIVERSITY, KUMARACOIL

B.E. BIOMEDICAL ENGINEERING

LIST OF ELECTIVES

Sl.No	Course Code	Course Title	L	T	P	C
1	BM12A1	Biomechanics	3	0	0	3
2	BM12A2	Medical Optics	3	0	0	3
3	BM12A3	Computers in Medicine	3	0	0	3
4	BM12A4	Bio-MEMS	3	0	0	3
5	BM12A5	Physiological Modeling	3	0	0	3
6	BM12A6	Medical Informatics	3	0	0	3
7	BM12A7	Nano Technology and its application in Medicine	3	0	0	3
8	BM12A8	Bio-materials and Implants	3	0	0	3
9	BM12A9	Biofluids and Dynamics	3	0	0	3
10	BM12B1	Radiological Equipment	3	0	0	3
11	BM12B2	Artificial Organs	3	0	0	3
12	BM12B3	Neural Networks & Artificial Intelligence	3	0	0	3
13	BM12B4	Rehabilitation Engineering	3	0	0	3
14	BM12B5	Ergonomics	3	0	0	3
15	BM12B6	Tissue Engineering and R-DNA Technology	3	0	0	3
16	BM12B7	Biomedical Waste Management	3	0	0	3

UNIT:I BASIC CONCEPTS 9

Newton's laws, Force Vector, Normal and Tangential forces, Tensile and Compressive forces, Moment and Torque, Magnitude of moment, direction, Dimension and Units. Moment as a vector product.

UNIT:II STATICS AND MOTION OF THE BODY 9

Statics and Motion of the body: Forces in the Achilles tendon, forces on the Hip. Stress and strain, Shear, hydrostatics. Statics of the body: the lower arm. Hip. Statics of synovial joints. Kinematics and musculature. Forces on the feet.

UNIT:III MUSCULOSKELETAL SYSTEM 9

Material components of the body. Elastic properties, bone shortening. Energy storage in elastic media. Viscoelasticity in bone, bone fractures. Total muscle tension, Muscle fatigue. Biomechanics of bone and ligament.

UNIT: IV LUNG MECHANICS 9

Structure of the lung, mechanical model of breathing and breathing parameters. Methods for determining lung pressure and volume, airway resistance and conductance.

UNIT: V APPLYING BIO MECHANICS IN SPORTS AND MEDICINE 9

Exercise specificity, injury risk, injury mechanisms, equipment

TOTAL: 45 PERIODS**REFERENCES:**

1. Bio Mechanics Circulation: Y.C. Fung.
2. Fundamentals of Biomechanics: Nihat Ozkay & Margareta Nordin.
3. Physics of the Human Body. Irving P. Herman
4. Fundamentals of Biomechanics. Duane Knudson

BM12A2 **MEDICAL OPTICS** **3 0 0 3**

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

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

UNIT: II **INSTRUMENTATION IN PHOTONICS** **9**

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

UNIT: III **APPLICATIONS OF LASERS** **9**

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

UNIT: IV **OPTICAL HOLOGRAPHY** **9**

Wavefronts, Interference patterns, principle of hologram, optical hologram, applications.

UNIT: V **SPECIAL TECHNIQUES** **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tuan VoDirh, "Biomedical photonics – Handbook", CRC Press, BocaRaton, 2003 (Unit I – III, V).
2. Leon Goldman, M.D., & R. James Rockwell, Jr., "Lasers in Medicine", Gordon and Breach, Science Publishers Inc., New York, 1971 (Unit IV).

BM12A3 **COMPUTERS IN MEDICINE** **3 0 0 3**

UNIT I **OVERVIEW OF COMPUTER HARDWARE PC-AT** **9**

8086 architecture, system connections, Instruction set & programming, Microcontrollers, Motherboard and its logic, RS232-C and IEEE bus standards, CRT controllers, FDC, HDC and Post sequence, PC based video card, modems and networking.

UNIT II **SYSTEM DESIGN** **9**

Multichannel computerised ECG, EMG and EEG data acquisition, storage and retrieval, transmission of signal and images.

UNIT III **COMPUTERS IN PATIENT MONITORING** **9**

Physiological monitoring, automated ICU, computerised arrhythmia monitoring, information flow in a clinical lab, computerised concepts, interfacing to HIS.

UNIT IV COMPUTERS IN MEDICAL SYSTEMS MODELLING 9
Radiotherapy, drug design, drug delivery system, physiological system modelling and simulation.

UNIT V COMPUTERS IN MEDICAL RESEARCH 9
Role of expert systems, pattern recognition techniques in medical image classification, ANN concepts.

TOTAL: 45 PERIODS

TEXT BOOKS

1. R.D.Lee, "Computers in Medicine", Tata McGraw-Hill, New Delhi, 1999.
2. Douglas V.Hall, "Microprocessors and Interfacing : Programming and hardware", McGraw-Hill, Singapore, 1999.

BM12A4 BIO MEMS 3 0 0 3

UNIT: I INTRODUCTION 9
Historical background of Micro Electro Mechanical Systems, Types of MEMS devices, MEMS Microsystems, Integrated MEMS and Microsystems.

UNIT: II MATERIALS AND PROCESSES 9
Materials used in MEMS, Properties of silicon, fabrication techniques, lithography, etching, wafer bonding, bulk and surface micromachining, Thin film deposition.

UNIT: III BIOSENSORS 9
Different types of biosensors, Detection techniques: optical, electrical, mechanical, SPR based. Specific examples: glucose sensor, urea sensor. Enzyme immobilization techniques.

UNIT: IV MICROFLUIDS AND BIOCHIPS 9
Fundamentals of microfluidics, Lab-on-a-chip devices, Silicon and glass micromachining for micro total analysis systems. Biochips and their applications in medical treatment.

UNIT: V APPLICATIONS OF BIOMEMS 9
MEMS devices for diagnostics, drug delivery, implantable devices, shape memory implants, MEMS for neurosurgery, Microneedles.

TOTAL: 45 PERIODS

REFERENCES:

1. Fundamentals of microfabrication, 2nd Edition, by Marc Madou
2. Fundamentals of semiconductor fabrication. Gary S. May and Simon Sze
3. Therapeutic Micro/Nano technology, Tejal Desai and Sangeeta Bhatia (editors).
4. Lab-on-a-chip. R. Edwin Oosterbroek and Albert van den Berg (editors).

UNIT: III COMPUTERS IN SYSTEM DESIGN 9

Hospital Information System its design and functional characteristics; Principles and application of Artificial Intelligence, Pattern Recognition, Neural Network and Fuzzy Logic in Medicine.

UNIT: II MULTIMEDIA AND VIRTUAL REALITY APPLIED TO MEDICINE 9

Basic concepts of Multimedia; Design of Multimedia information systems; Components of virtual reality; Virtual reality applications in medicine.

UNIT: V COMPUTERS IN MEDICAL RESEARCH 9

Medical Informatics and its levels; Design and development of educational packages on medical sciences; Integrated design concepts; Interactive multimedia, Virtual and digital libraries, Internet and its applications.

TOTAL: 45 PERIODS

TEXT BOOK:

1. R.D.Lele, "Computer in Medicine", Tata McGraw-Hill, New Delhi, 1997.

REFERENCES:

1. Tay Vaughan, "Multimedia making it work", Tata McGraw-Hill, New Delhi, 1997.
2. Davis Chapman, "Teach Yourself Visual Basic 6 in 21 days", New Delhi, 1997.
3. Harold Sackman, "Biomedical Information Technology", Academic Press, New York, 1997.
4. Mary BrthFecko, "Electronics Resources: Access and Issues", Bowker and Saur, London, 1997

BM12A7 NANOTECHNOLOGY AND ITS APPLICATIONS IN MEDICINE 3 0 0 3

UNIT: I INTRODUCTION TO NANOTECHNOLOGY 9

Nanotechnology - Scientific revolutions – types of nanotechnology and nano machines – Basic problems and limitations - opportunities at the nanoscale – time and length scale in structures misnomers and misconceptions in Nanotechnology.

UNIT: II NANOBIOLOGY FOR NANOMEDICINE 9

Structure and organization of prokaryotic and eukaryotic cell – transport processes across cell membrane – active transport – passive transport – facilitated transport – signal transduction - Molecular biology: Mutation - Biogenic Nanoparticles – Biomineralization – bio-nano molecular motors . Protein based Nanostructures.

UNIT: III BIOTECHNOLOGY 9

Biology inspired concepts - biological networks – biological Neurons – the function of neuronal cell – bioelectronics – molecular Processor – DNA analyzer as biochip – molecular electronics - Nano-biometrics.

UNIT: IV NANOBIO TECHNOLOGY 9

Biological computing – DNA as wire template – DNA computer - Natural nano composites – natural, biologically synthesized, biologically derived synthetic – protein based nanostructure formation – biologically inspired.

UNIT: V NANOMEDICINE 9

History of Nanomedicine – Taxonomy – BioPharmaceuticals – Nanomedicine introduction, nanotoxicology, nanopharmaceuticals, medical Nanodevices - Electrochemical Nanoelectrodes – Nanoelectrode properties – applications in biomedicine – Nanobot medical devices - New generations of prosthetic and medical implants – biocompatibility and reduced rejection ratio – Nanostructured Surface Modifications for Biomedical Implants – Orthopedic & dental implants - nanostructured hydroxyapatite coatings.

TOTAL: 45 PERIODS

REFERENCES:

1. Understanding Nanotechnology, Scientific American, Warner Books, 2002.
2. Introduction to Nanotechnology by Charles P. Poole, Frank J. Owens, Wiley-Interscience, 2003.
3. Biomaterials Science: An Introduction to Materials in Medicine, Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, Academic Press, 1st edition, 1997.
4. Cell & Molecular Biology – Concepts & Experiments, 3/e, Gerald Karp, John Wiley & Sons, 2007
5. Bionanotechnology: Lessons from Nature, David S. Goodsell, Wiley-Liss, 2004.
6. NanoBiotechnology Protocols: Methods in Molecular Biology, Sandra J Rosenthal, David W. Wright, Humana Press, 1st Edition, 2005.
7. Encyclopedia of Nanoscience & Nanotechnology, H. S. Nalwa (Ed.), American Scientific Publishers, California, 2004.

BM12A8 BIO-MATERIALS AND IMPLANTS 3 0 0 3

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

Definition and structure of bio-materials, Properties and characterization of bio-Materials, body response to implants, Protein adsorption , Biofilm formation, blood compatibility. Classes of materials used in medicine, Bioresorbable and Biodegradable Materials, composites thin films, grafts, Coatings medical fabrics and Biologically functional materials, Smart materials, Nano bio materials.

UNIT: II HOST REACTIONS TO BIOMATERIALS 9

Inflammation, Wound healing and the Foreign body response. Systemic toxicity and Hypersensitivity. Blood coagulation and Blood-material Interactions. Tumorigenesis, implant associated infection.. Degradation of materials in the biological environment, Skin substitutes

UNIT: III APPLICATIONS OF BIO- MATERIAL IN DEVICES AND IMPLANT 9

Cardiovascular medical devices, Dental implants, Ophthalmologic applications- intraocular lens implants, Soft-tissue replacements, surgical tapes, adhesive, percutaneous and skin implants, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT: IV STANDARDS AND REGULATIONS FOR MEDICAL IMPLANT 9

Sterilization of implants and Devices; Failure of implants and Devices, Performance of drug delivery systems, Standards development and regulation of medical products using biomaterials, Testing of biomaterials: In vitro & In vivo assessment of tissue compatibility, Testing of blood-materials interactions

UNIT: V ARTIFICIAL ORGANS 9

Artificial Heart, Prosthetic Cardiac Valves, Limb prosthesis, Artificial pancreas, bionic ear

TOTAL: 45 PERIODS

TEXT BOOKS:

1. PARK J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
2. Biomaterials Science: An Introduction to Materials in Medicine Buddy D.
3. Ratner, Frederick J. Schoen
4. Allan S. Hoffman, Jack E. Lemons, Academic Press, 1996
5. Hench L LEthridgc E.C. Biomaterials, an interfacial approach, Academic Press, 1982

REFERENCES:

1. Bronzino J D, the biomedical engineering handbook CRC Press.
2. Shayne Cox Gad (ed.) 2nd Edition, Safety Evaluation of Medical Devices, Marcel Dekker Inc., New York, 2002.

BM12A9 BIO-FLUID AND DYNAMICS 3 0 0 3

UNIT: I INTRODUCTORY CONCEPTS 9

Fluids and non-fluids, continuum coordinate systems, force and moments, stress at a point, rate of strain, properties of fluids, classification of fluids.

UNIT: II FLUID FLOW 9

Different types of fluid flows, laminar and turbulent flow, transition from laminar to turbulent flow, laminar flow-annulus, laminar flow between parallel plates, measurement of viscosity.

UNIT: III BOUNDARY LAYER FLOW 9

Development of boundary layer, estimates of boundary layer thickness, boundary layer equation, nature of turbulence, smooth and rough surface, boundary layer separation.

UNIT: IV PRESSURE AND FLOW IN BLOOD VESSELS 9

Friction loss in flow in a tube, velocity distribution of aortic system, waveform of pressure and velocity in aorta, wave reflections and impedance in arterial segments, blood flow in veins and blood flow in capillaries.

UNIT : V ANALYSIS OF CARDIO VASCULAR DYNAMICS 9

Control theory and system analysis, mechanical analysis of circulatory systems, basic concept of myocardial mechanics, index of contractibility, fluid dynamics of aortic and mitral valves.

TOTAL: 45 PERIODS

REFERENCES

1. K.L.Kumar, "Engineering fluid mechanics", Eurasia Publishing House (P) Ltd., New Delhi, 1998.
2. D.H.Bergel, "Cardiovascular fluid dynamics"- Vol. I, Academic press, London & New York, 1972.

BM12B1 RADIOLOGICAL EQUIPMENT 3 0 0 3

UNIT I MEDICAL X-RAY EQUIPMENT 9

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

UNIT II COMPUTED TOMOGRAPHY 9

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

UNIT III MAGNETIC RESONANCE IMAGING 9

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

UNIT IV NUCLEAR MEDICINE SYSTEM 9

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

UNIT V RADIATION THERAPY AND RADIATION SAFETY 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Leslie Cromwell, “Biomedical Instrumentation and measurement”, Prentice hall of India, New Delhi, 1997.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 1997.

REFERENCES:

1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, New York, 1998.
2. Joseph J.carr and John M. Brown, “introduction to Biomedical equipment technology”, John Wiley and sons, New York, 1997.

BM12B2 ARTIFICIAL ORGANS 3 0 0 3

UNIT - I DESIGN OF ARTIFICIAL ORGANS 9

Substitutive medicine, Biomaterial Concentration, Outlook for Organ Replacement, Design Consideration, Evaluation of Artificial Organs.

UNIT - II ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES 9

Design of Artificial heart, History of Artificial Heart, Types of Valve Prostheses, Thrombus Deposition, Durability, Mechanical Circulatory Assistance, Two Main Categories, Intra- Aortic Balloon Pump, Percutaneous Cardio-Pulmonary Bypass,

UNIT - III ARTIFICIAL LUNGS AND BLOOD GAS EXCHANGE DEVICES 9

Gas Exchange Systems, Cardio Pulmonary Bypass, Comparison of Artificial Lungs and Natural Lungs, Oxygen Transport, Carbon-di-oxide Transport, Coupling of Oxygen & Carbon-di-oxide Exchange, Shear Induced Transport, Augmentation and Devices for Improved Gas Transport.

UNIT - IV ARTIFICIAL KIDNEY & ARTIFICIAL PANCREAS: NUMBER OF HOURS 9

Artificial Kidney: Renal Transplantation, Mass Transfer in Dialysis, Membranes, Hemofiltration, Adequacy of Dialysis, Peritoneal Dialysis Equipment. Artificial pancreas: Insulin Therapy, Therapeutic options in Diabetes, Insulin Administration System, Insulin Production System.

UNIT - V ARTIFICIAL BLOOD & ARTIFICIAL LIVER 9

Artificial Blood: Plasmapheresis, Blood Substitutes, Hemodilution, Classification, Characterisation of substitutes. Artificial Liver, Liver Support Systems, Global Liver Function Replacement, Hybrid Liver Function Replacement.

TOTAL: 45 PERIODS

REFERENCES:

1. 'Tissue Engineering and Artificial Organs' By Joseph D. Bronzino
2. 'Cardiogenic Shock' by Steven M. Hollenberg.
3. 'Biomaterials, Artificial Organs and Tissue Engineering' by Larry L. Hench and Julian R. Jones.
4. "Artificial Organs" by Gerald E. Miller Morgan & Claypool Publisher

BM12B3 NEURAL NETWORKS & ARTIFICIAL INTELLIGENCE 3 0 0 3

UNIT I INTRODUCTION TO SIMPLE NEURAL NET 9

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

UNIT II BACK PROPAGATION AND ASSOCIATIVE MEMORY 9

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

UNIT III NEURAL NETWORKS BASED ON COMPETITION 9

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

UNIT IV INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

History and applications, Components of AI Structures and Strategies for state space search – Data driven and goal driven search, Depth First and Breadth First Search, DFS with Iterative Deepening, Heuristic Search- Best First Search, A* Algorithm, Constraint Satisfaction, Knowledge representation-Propositional calculus

UNIT V LATEST TRENDS AND APPLICATIONS OF ARTIFICIAL INTELLIGENCE 9

Linear Discriminant Analysis, Quadratic Discriminant Analysis, Independent Component Analysis, Principal Component Analysis, Performance Analysis of Classifiers, Introduction to Genetic Algorithm based on Schemata Theory, Convergence Analysis, Application of GA in Optimization Problems and Machine Learning, Particle Swarm Optimization.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Hagan, Demuth and Beale, "Neural network design", Vikas Publishing House Pvt Ltd., New Delhi, 2002
2. Laurene Fausett, "Fundamentals of neural networks-

- Architectures, algorithms and applications”, Prentice Hall, 1994
3. Elain Rich and Kevin Knight, “Artificial Intelligence”, 2nd Edition, Tata McGraw-Hill, 1993.
 4. Amit Konar, “Artificial Intelligence and Soft Computing: Behavioral and Cognitive Modeling of Human Brain”, vol.1, CRC Press, 1999.
 5. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley Longman Publishing, New York, USA, 1989.

REFERENCES

1. Freeman J.A., and Skapura B.M, “Neural Networks, Algorithms, Applications and Programming Techniques”, Addison - Wesley, 2003.
2. Earl Gose, Richard Johnson baugh Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt Ltd., New Delhi, 1999.
3. Robert Schalkoff, “Pattern recognition, Statistical, Structural and neural approaches” John Wiley and Sons (Asia) Pvt Ltd., Singapore, 2005.
4. Duda R.O. Hart P.G, “Pattern Classification and scene analysis”, Wiley Edition 2000.

BM12B4

REHABILITATION ENGINEERING

3 0 0 3

UNIT: I

REHABILITATION CONCEPTS

9

Engineering Concepts in Sensory Rehabilitation; Engineering Concepts in Motor Rehabilitation; Engineering Concepts in Communication Disorders Orthopedic prosthetics and orthotics in Rehabilitation: Basics and Fundamentals in rehabilitation and its applications. Knowledge of disability act 1995 for physically disabled, visually impaired, hearing impaired and others

UNIT: II

ORTHOTICS AND PROSTHETICS DEVICES

9

Intelligent prosthetic knee. A hierarchically controlled prosthetic hand. A self-aligning orthotic knee joint. FES systems: Restoration of hand function: Hybrid Assistive Systems (HAS). Active prosthesis: Active Above Knee Prostheses. Myoelectric hand and arm prostheses. Wheeled Mobility: Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of Wheel chair propulsion. Power Wheelchair Electrical Systems. M Control Personal Transportation.

UNIT: III SENSORY AUGMENTATION AND SUBSTITUTION

9

Visual system: Visual augmentation. Tactual vision substitution. Auditory vision substitution: Auditory system: Auditory augmentation. Cochlear implantation. Visual auditory substitution. Tactual auditory substitution. Tactual system: Tactual augmentation. Tactual substitution. Augmentative communication; Environmental Control systems and Robotic manipulation aids; Environmental Control and Access to computers.

UNIT: IV MEASUREMENT TOOLS AND PROCESSES IN REHABILITATION ENGINEERING

9

Fundamental Principles: Structure function: Performance and Behaviour Subjective and Objectives measurement methods. Measurements and assessments; measurement

Objectives and Approaches;. Decision Making Process; Current Limitations: Quality of measurements, standards. Rehabilitation service delivery and Rehabilitation Engineering.

UNIT: V COMPUTER APPLICATIONS IN REHABILITATION ENGINEERING 9

Interfaces in Compensation for visual perception.Improvement of orientation and mobility. Computerassisted lip reading. Brain-computer interfaces. Computer-Aided Engineering in customized component design.

TOTAL: 45 PERIODS

REFERENCES:

1. Robinson C.J. Rehabilitation Engineering, CRC Press. 1995
2. Ballabio E. et al..Rehabilitation Technology, IOS Press. 1993

BM12B5

ERGONOMICS

3003

UNIT I

9

Process of seeing – visual capabilities-factors affecting visual acuity and contrast sensitivity – human factorsaspects of hard copy text and computer screen text, factors in selecting graphic representations symbols,qualitative visual display-process of hearing-principles of auditory display.

UNIT II

9

Muscle physiology-muscle metabolism-respiratory response-joint motion study-measure of physiological in-efficiency and energy consumption-work rest cycles-aspects of manual and posture study, materialhandling (MMH) Bio-mechanical recommended limits of MMH.

UNIT III

9

Spatial compatibility physical arrangement of displays and controls- movement capability- rotary controls and rotar displays movement of displays orientation of the operator and movement relationships controlorders and control responses- human limitations in tracking task.

UNIT IV

9

Anthropometry- anthropometric design principles –work space envelope- factors in design of workspacesurfaces- principles of seat design –principles of control panel.Organization classification of human errorstheories of accident causation-reducing accidents by altering behavior.

UNIT V

9

1. Case Study 1: computer design, control panel design of an electronic instrument, computer key board, hand drill etc.
2. Case Study 2: Biomedical Application, Design optimization of Medical Equipments.

TOTAL: 45 PERIODS

REFERENCES:

1. Pascale Carayon, Handbook of Human Factors and Engineering
2. Robert.N. Bailey, Human Performance Engineering
3. Martin Helander, Guide to Human Factors and Ergonomics

BM12B6 TISSUE ENGINEERING AND R-DNA TECHNOLOGY 3 0 0 3**UNIT I HISTORICAL PERSPECTIVE OF TISSUE ENGINEERING 9**

Historical perspective of tissue engineering industry and products, Cell sources, culture conditions, three dimensional interactions, cell reprogramming, Stem cells (embryonic), Stem cells (adult), Extracellular matrix. Stem cells and its applications

UNIT II ENGINEERING METHODS AND DESIGN 9

Tissue Biomechanics, Scaffold design and fabrication, Tissue Engineering of Skin, Bone, Cartilage, Neurons, Cardiovascular Tissue Engineering, Musculoskeletal system (tendon/ligament/muscle) and Adipose Tissue.

UNIT III ISOLATION OF GENOMIC AND NUCLEAR DNA 9

Introduction to DNA, DNA digestion and restriction fragment analysis and sequencing by chemical, enzymatic and big-bye terminator methods.

UNIT IV CLONING AND SUBCLONING STRATEGY 9

Construction of recombinant DNA: Preparation of competent cell-Transformation, transfection – Recombinant selection and screening; Genomic DNA library; cDNA synthesis strategies – Linkers – Adapters – Homo polymer tailing.

UNIT V SELECTION OF RDNA CLONES AND THEIR EXPRESSION PRODUCTS 9

Direct and indirect methods. Drug resistance, gene inactivation, DNA hybridization, colony hybridization and in-situ hybridization (Southern, Northern and Dot blots and immunological techniques Western blotting).

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Biomaterials, artificial organs and Tissue engineering, Larry L. Hench, Julian.R Jones, Wood head publishing Ltd, 2005.
2. Principle of Tissue Engineering, Robert P.Lanza, Robert Langer William L.Chick. Academic Press, 2004.
3. “Principles of Gene Manipulation” by R.W.Old and S.B.Primrose2002 Sixth Edition Blackwell Scientific Publication
4. “Genes VI” by B.Lewin, 2012. IXth Eds. Oxford University Press

REFERENCES:

1. Tissue Engineering, by Palsson and Bhatia (eds.), Published by Pearson Prentice Hall, 2004

2. "From genes to clones: By E-L Winnacker. pp 634. VCH Verlagsgesellschaft, Weinheim, FDR. 1987.
3. "Gene Cloning " by T.A.Brown Vch Pub (1997)634 pages

BM12B7 BIOMEDICAL WASTE MANAGEMENT 3 0 0 3

UNIT I INTRODUCTION 9

Definition of general and hazardous healthcare waste, Infectious waste, geno-toxic waste, waste sharps, categorization and composition of Biomedical waste, major and minor sources of biomedical waste, Segregation of waste, Color coding, waste handling and disposal.

UNIT II HAZARD OF BIOMEDICAL WASTE 9

Need for disposal of biomedical waste, Specifically Communicable diseases, Diseases epidemiology and mode of transmission of disease, Environmental pollution by biomedical waste-causes, consequences, mitigation and remedies.

UNIT III CONTROL OF HOSPITAL ACQUIRED INFECTION 9

Types of infection – Common Nosocomial infection and their Causative Agents– Prevention of hospital acquired infection–Role of central sterile supply department–Infection control committee –Monitoring and control of cross infection-Staff health.

UNIT IV TREATMENT TECHNOLOGIES FOR WASTES 9

Mechanical Treatment & Chemical Disinfections, Conventional Treatment Technologies: Wet thermal technology, Incineration, Microwave Technology, Autoclave system, Hydroclave system, Electro Thermal Reactivation (ETP), Treatment Process Electron beam Technology, Plasma Pyrolysis / Gasification systems

UNIT V LAWS OF BIOMEDICAL WASTE HANDLING 9

Biomedical wastes ,Disposal of biomedical waste products and deep burial, Segregation, Packaging, Transportation, Storage Legislation, policies and law regarding environment on Healthcare waste Management, Biomedical waste management and handling rules 1998 and its amendment. CPCB guidelines. World Health Organization guidelines on Management of wastes from hospital wastes.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Anantpreet Singh, Sukhjit Kaur, "Biomedical Waste Disposal", 1st ed., Jaypee Publishers (P) Ltd, India, 2012.
2. Sushma Sahai, "Bio-Medical Waste Management" , APH Publishing Corporation, India, 2009.

REFERENCE:

1. Sanskriti Sharma, "Hospital Waste Management and Its Monitoring" , Jaypee Publishers (P) Ltd, India, 2002.