NEW COURSE-SCHEME
B. TECH. (BIOMEDICAL ENGINEERING) WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR – 125001

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR

I SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total Credits
MATH-101-E	Mathematics-I	3	2	-	4.0
PHY-101-E	Physics-I	3	1	-	3.5
ME-101-E	Elements of Mechanical Engineering	3	1	-	3.5
CSE-101-E	Fundamentals of Computer & Programming in C	3	1	-	3.5
CYL-101	Chemistry-I	3	1	-	3.5
BME-101	Anatomy & Physiology-I	3	2	-	4.0
PHY-103-E	Physics-I Lab	-	-	2	1.0
ME-107-E	Workshop Practice	-	-	4	2.0
CYP-103	Chemistry-I Lab	-	-	2	1.0
CSE-103-E	C Programming Lab	-	-	2	1.0
BME-103	Anatomy & Physiology-I Lab	-	-	2	1.0
Total		18	8	12	28

L = Lecture, T = Tutorial, P = Practical

NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
II SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total Credits
HUM-102-E	Communication skill in English	3	1	-	3.5
MATH-102-E	Mathematics-II	3	2	-	4.0
PHY-102-E	Physics-II	3	1	-	3.5
CYL-201	Chemistry-II	3	1	-	3.5
BME-104	Anatomy & Physiology-II	3	2	-	4.0
EE-101-E	Electrical Technology	3	1	-	3.5
PHY-104-E	Physics-II Lab	-	-	2	1.0
CYP-203	Chemistry-II Lab	-	-	2	1.0
ME-105-E	Engineering Graphic & Drawing	1	-	4	3.0
BME-108	Anatomy & Physiology-II Lab	-	-	2	1.0
EE-103-E	Electrical Technology Lab	-	-	2	1.0
	Total	19	8	12	29

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
III SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
MATH-201-E	Mathematics-III	3	2	-	4.0
BME-201	Histology	3	1	-	3.5
BME-203	Electronic Devices And Components	3	1	-	3.5
BME-205	Analog Electronics-I	3	1	-	3.5
BME-207	Biochemistry	3	1	-	3.5
BME-209	Signals & Systems	3	1	-	3.5
BME-211	Histology Lab	-	-	2	1.0
BME-213	Analog Electronics-I Lab	-	-	3	1.5
BME-215	Biochemistry Lab	-	-	2	1.0
	Total	18	7	7	25.0

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
IV SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-202	Biomedical Instrumentation-I	3	1	-	3.5
BME-204	Transducers & Sensors	3	2	-	4.0
BME-206	Digital Circuits and Systems	3	1	-	3.5
BME-208	Analog Electronics-II	3	1	-	3.5
Math-202-E	Numerical Methods	3	1	-	3.5
BME-212	Biomedical Instrumentation-I lab	-	-	3	1.5
BME-214	Transducers & Sensors Lab	-	-	3	1.5
BME- 216	Digital Circuits & Systems Lab	-	-	3	1.5
BME-218	Analog Electronics-II Lab	-	-	3	1.5
Math-204-E	Numerical Methods Lab	-	-	2	1.0
	Total	15	6	14	25.0

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
V SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-301	Biomedical Instrumentation-II	3	1	-	3.5
BME-303	Clinical Sciences-I	3	1	-	3.5
BME-305	Medical Imaging Technology-I.	3	1	-	3.5
BME-307-ECE	Communication Engg.	3	1	-	3.5
BME-309-ECE	Fields & Waves	3	1	-	3.5
BME-311	Control System in Medicine	3	1	-	3.5
BME-313	Biomedical Instrumentations –II Lab	-	-	2	1.0
BME-315	Clinical Sciences-I Lab	-	-	2	1.0
BME-317	Medical Imaging Technology Lab	-	-	2	1.0
BME-319-ECE	Communication Engg. Lab	-	-	2	1.0
	Total	18	6	8	25.0

NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
VI SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-302	Medical Devices	3	1	-	3.5
BME-204	Clinical Sciences-II	3	1	-	3.5
BME-306	Microprocessor	3	1	-	3.5
BME-308	Biomaterials & Components	3	1	-	3.5
BME-310	Biomechanics	3	1	-	3.5
BME-312	Rehabilitation Engg	3	1	-	3.5
BME-314	Medical Devices Lab	-	-	2	1.0
BME-318	Clinical Sciences-II Lab	-	-	2	1.0
BME-316	Microprocessor Lab	-	-	2	1.0
BME-320	Biomechanics Lab	-	-	2	1.0
	Total	18	6	8	25.0

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR

VII SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-401	Biomedical Signal Processing	3	1	-	3.5
BME-403	Medical Imaging & Image Processing	3	1	-	3.5
BME-405	Medical Imaging Tech	3	-	-	3.0
BME-407	Laser & Fiber Optics in Medicine	3	-	-	3.0
BME-	Electives*	3	1	-	3.5
BME-409	Bio-Signal Conditioning	3	1	-	3.5
BME-411	Biomedical Signal Processing Lab	-	-	2	1.0
BME-413	Laser & Fiber Optics Lab	-	-	2	1.0
BME-415	Bio-Signal Conditioning Lab	-	-	2	1.0
BME-417	Minor Project	-	-	4	2.0
	Total	18	4	10	25.0

*= Electives:

1. BME-501   Nanotechnology in Medicine
2. BME-502   Hospital Management
3. BME-503   Nuclear Medicine

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
VIII SEMESTER
Scheme for B. Tech. Biomedical Engineering Programme

16 weeks Industrial/Professional training programme in Manufacturing Industries/Hospital/ R & D Organizations

Credits Distribution:		**Credits**
1. **Regular assessment & Seminar**	=	**5.0**
2 **Training Report evaluation**	=	**5.0**
3. **Viva Voice**	=	**8.0**

(One internal examiner and two external examiners)

Total	=	**18.0**

PROPOSED NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

Grand Total of Credits for the B. Tech Biomedical Engineering, GJUS&T, Hisar.

Semester-I   :   28.0

Semester-II   :   29.0

Semester-III   :   25.0

Semester-IV   :   25.0

Semester-V   :   25.0

Semester-VI   :   25.0

Semester-VII   :   25.0

Semester-VIII   :   18.0

Total   :   **200.0**

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR

I SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total Credits
MATH-101-E	Mathematics-I	3	2	-	4.0
PHY-101-E	Physics-I	3	1	-	3.5
ME-101-E	Elements of Mechanical Engineering	3	1	-	3.5
CSE-101-E	Fundamentals of Computer & Programming in C	3	1	-	3.5
CYL-101	Chemistry-I	3	1	-	3.5
BME-101	Anatomy & Physiology-I	3	2	-	4.0
PHY-103-E	Physics-I Lab	-	-	2	1.0
ME-107-E	Workshop Practice	-	-	4	2.0
CYP-103	Chemistry-I Lab	-	-	2	1.0
CSE-103-E	C Programming Lab	-	-	2	1.0
BME-103	Anatomy & Physiology-I Lab	-	-	2	1.0
	Total	18	8	12	28

L = Lecture, T = Tutorial, P = Practical

PROPOSED NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COUR

MATH-101-E   **MATHEMATICS-I**

L-3   T-2

Total Credits-4.0   (COMMON FOR ALL BRANCHES)

Part-A

Infinite series : Convergence and divergence, Comparison, D' Lambert's ratio, Integral, Raobes, Logarithmic and Cauchy root tests, Alternating series, Absolute and conditional convergence.

Applications of Differentiation: Taylor's and Maclaurin's series, Asymptotes, Curvature Asymptotes.

Partial Differentiation & its Applications : Functions of two or more variables; partial derivatives, Total differential and differentiability, Derivatives of composite and implicit functions, Jacobians, Higher order partial derivatives.

Homogeneous functions, Euler's theorem, Taylor's series for functions of two variables (without proof), maxima-minima of function of two variables, Lagrange's method of undetermined multipliers, Differentiation under integral sign.

Part-B

Applications of Single & Multiple Integration: Applications of single integration to find volume of solids and surface area of solids of revolution. Double integral, change of order of integration, Double integral in polar coordinates, Applications of double integral to find area enclosed by plane curves and volume of solids of revolution. Triple integral, volume of solids, change of variables, Beta and gamma functions and relationship between them.

Vector Calculus : Differentiation of vectors, scalar and vector point functions Gradient of a scalar field and directional derivative, divergence and curl of a vector field and their physical interpretations.   Integration of vectors, line integral, surface integral, volume integral, Green, Stoke's and Gauss theorems (without proof) and their simple applications.

TEXT BOOKS :

1. Advanced Engineering Mathematics: F. Kreyszig.
2. Higher Engineering Mathematics: B.S. Grewal.

REFERENCE BOOKS:

1. Engineering Mathematics Part-I: S.S. Sastry.

2. Differential and Integral Calculus: Piskunov.
3. Advanced Engineering Mathematics: R.K. Jain and S.R.K.Iyengar
4. Advanced Engg. Mathematics: Michael D. Greenberg

Note: Examiner will set eight questions, taking four from Part-A and four from Part-B. Students will be required to attempt five questions taking at least two from each part.

PHY-101-E   **PHYSICS-I**
                                   (COMMON FOR ALL BRANCHES)

L-3   T-1
Total Credit-3.5   **PART-A**

PHYSICAL OPTICS

Interference: Division of wave front-Fresnel's biprism, Division of amplitude –
   Newton's rings, Michelson interferometer, applications.

Diffraction: Difference between Fraunhofer and Fresnel diffraction. Fraunhofer
diffraction through a slit.   Plane transmission diffraction grating, its dispersive and
resolving powers.

Polarization : Polarised and unpolarized light, double refraction; Nicol prism,
quarter and half wave plates, Polarimetry**;** Biquartz and Laurent's half-shade
polarimeters, Simple concepts of photoelasticity.

LASER
Spontaneous   and   stimulated   emissions,   Laser action, characteristics of laser
beam-concepts of coherence, He-Ne and semiconductor lasers (simple ideas),
applications.

FIBRE OPTICS
   Propagation of light in fibres, numerical aperture, single mode and multi mode
fibres, applications.

                                            PART-B

WAVE AND OSCILLATIONS

 Simple concepts of Harmonic Oscillator, resonance, quality factor. E.M. wave
theory-review of basic ideas, Maxwell's equations, simple plane wave equations,
simple concepts of wave guides and co-axial cables, Poynting vector.

DIELECTRICS
Molecular theory, polarization, displacement, susceptibility, dielectric coefficient,
permitivity & various relations between these, Gauss's law in the presence of a
dielectric, Energy stored in an electric field. Behaviour of dielectrics in AC. field-
simple concepts, dielectric losses.

SPECIAL THEORY OF RELATIVITY
Michelson-Moreley experiment, Lorentz transformations, variation of mass with
velocity, mass energy equivalence.

NUCLEAR PHYSICS
Neutron Cross-section, Nuclear fission, Moderators, Nuclear reactors, Reactor
criticality, Nuclear fusion. Interaction of radiation with matter-basic concepts,

radiation detectors-ionisation chamber, G.M. Counter Scintillation and solid state detectors, cloud chamber and bubble chamber.

TEXT BOOKS :
1. Physics of the Atom - Wehr, Richards & Adair (Narosa)
2. Perspectives of Modern Physics - Arthur Beiser (TMH)
3. Modern Engineering Physics – A.S. Vasudeva (S. Chand)

REFERENCE BOOKS :
1. Electricity and Magnetism – F.W. Sears (Narosa)
2. Physics Vol-I & II – Resnick & Halliday (Wiley Eastern)
3. A Text Book of Optics – Brij Lal & Subramanyam

Note: The Examiners will set eight questions, taking four from each part. The students will be required to attempt five questions in all selecting at least two from each part. All questions will carry equal marks.

ME- 101 E   ELEMENTS OF MECHANICAL ENGINEERING
L-3   T-1
Total Credit-3.5

Unit I   Properties of Steam & Boilers:
Formation of steam at constant pressure, Thermodynamics properties of steam, Condition of steam, Steam tables, Measurement of dryness fraction by throttling calorimeter, Classification of boilers, Comparison of water and fire tube boilers mounting and accessories with their functions, Constructional and operational details of Cochran and Babcock and Wilcox boilers, Problems.

Unit II   Steam Turbines and Condensers:
Classification of turbines, Working principle of impulse and reaction turbine, Compounding of impulse turbine, Comparison of impulse and reaction turbines, Types of condensers, Cooling ponds and cooling towers, Condenser and vacuum efficiencies.

Unit III   I.C. Engines and Gas Turbines:
Introduction, Classification, Constructional details and working of two-stroke and four-stroke diesel and petrol engines, Otto, Diesel and Dual cycles, Working principle of gas turbine, Constant pressure gas turbine cycle.

Unit IV   Water Turbines, Pumps and Hydraulic Devices:
Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working, Hydraulic jack and lift.

Unit V   Simple Lifting Machines:
Definition of machine, Velocity ratio, Mechanical advantage, Efficiency, Laws of machines, Reversibility of machine, Wheel and axle, Differential pulley block, Single, double and triple start worm and worm wheel, Single and double purchase winch crabs, Simple and compound screw jacks. Problems.

Unit VI   Power Transmission Methods and Devices:
Introduction to Power transmission, Belt drive, Rope drive, Chain drive, Pulley, Gear drive, Types of gears, Gear train, Clutches, Types and function of clutches, Types and function of brakes, Power measurement by dynamometer, Types of dynamometers.

Unit VII   Stresses and Strains:
Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses and strains in simple and compound bars under axial loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships, Principle stresses & strains and principle-planes, Mohr's circle of stresses. Numerical problems.

Unit VIII   Bending Moment & Shear Force:
Definitions, SF and BM diagrams for cantilever and simply supported beam. Calculation of maximum SF, BM and point of contra-flexure under the loads of (i) concentrated load (ii) uniformly distributed load (iii) combination of concentrated and uniformly distributed loads. Problems.

Text Books:
1. Strength of Materials - G.H. Ryder, Pub.- ELBS.
2. Hydraulic and Fluid Mechanics – Modi and Seth, Pub. – Standard Book House, New Delhi
3. Engineering Thermodynamics – C.P. Arora, Pub. - TMH, New Delhi
4. Thermal Engineering – A.S. Sarad, Pub. - Satya Prakashan, New Delhi.
5. Engineering Mechanics – K.L. Kumar, Pub. - TMH, New Delhi.
6. Theory of Machines – S.S. Rattan, Pub. – TMH, New Delhi.

Reference Books:
1. Strength of Materials – Popov, Pub. - PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub.- Metropolitan, Allahbad.
3. Thermal Science and Engineering – D.S. Kumar, Pub. – Kateria & Sons, New Delhi.

NOTE: In the semester examination, the examiner will set eight questions, at least one question
 from each unit. The students will be required to attend only 5 questions.

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CSE -101 E   **FUNDAMENTALS OF COMPUTERS & PROGRAMMING IN C**
L-3   T-1
Total Credit-3.5

Unit-1: An Overview of Computer System: Anatomy of a digital Computer, Memory Units, Main and Auxiliary Storage Devices, Input Devices, Output Devices, Classification of Computers.
Radix number system: Decimal, Binary, Octal, Hexadecimal numbers and their inter-conversions; Representation of information inside the computers.

Unit-2:   Operating System Basics: The user Interface, Running Programmes, Managing files, Introduction to PC operating Systems: Unix/Linux , DOS, Windows 2000.

Unit-3:   Internet basics: : Introduction to the basic concepts of Networks and Data Communications, How Internet works, Major features of internet, Emails, FTP, Using the internet.

Unit-4:   Programming Languages: Machine-, Assembly-, High Level- Language, Assembler, Compiler, Interpreter, debuggers, Programming fundamentals: problem definition, algorithms, flow charts and their symbols, introduction to compiler, interpreter, assembler, linker and loader and their inter relationship.

Unit-5: C Programming language: C fundamentals, formatted input/ output, expressions, selection statements, loops and their applications;   Basic types, arrays, functions, including recursive functions,   program organization: local and external variables and scope; pointers & arrays.

Unit-6: Strings: strings literals, string variables, I/O of strings, arrays of strings; applications.

Preprocessor: preprocessor directives, macro definition, conditional compilation; Structures, Unions and Enumerations: Structure variables and operations on structures; Structured types, nested
Array structures; unions; enumeration as integers, tags and types.

Declaration: Declaration syntax, storage classes, type's qualifiers, declarators, initializers.

Program Design: modules, information hiding, abstract data types, difference between C & C++, Low
Level programming: Bitwise operators, Bit fields in structures, other low level techniques.

Unit-7: Standard library: Input / output; streams, file operations, formatted I/O, character I/O, line I/O,   block, string I/O, Library support for numbers and character data, error handling:

Text Books:
- Using Information Technology, 5th Edi, Brian K Williams & Stacey C. Sawyer, 2003, TMH
- The C Programming Language by Dennis M Ritchie, Brian W. Kernigham, 1988, PHI.
- C Programming – A modern approach by K.N. King, 1996, WW Norton & Co.

Reference Books:
- Information technology, Dennis P. Curtin, Kim Foley, Kunal Sen, Cathleen Morin, 1998, TMH

- Theory and problem of programming with C, Byron C Gottfried, TMH
- Teach yourself all about computers by Barry Press and Marcia Press, 2000, IDG Books India.
- Using Computers and Information by Jack B. Rochester, 1996, Que Education & Training.

Note: 8 questions will be set by the examiner (at least 2 questions from unit-1 to 4, 2 each from unit −5&6, and one from unit-7). The students will be required to attempt 5 questions in all.

CYL-101   :   **CHEMISTRY-I**
L-3 T-1   (COMMON FOR ALL BRANCHES)
Total Credit-3.5

Unit-1 :

Thermodynamics - Second law, concept of Entropy, Entropy change for an ideal gas, free energy and work functions, Free energy change, Chemical Potential, Gibb's Helmholtz equation, Clausius - Clapeyron equation, Related numerical problems with above topics.

Unit-2 :

Phase-Rule - Terminology, Derivation of Gibb's Phase Rule Equation, One Component System (H_2O System), Two Components systems, Eutectic system (Pb-Ag), system with congruent M.P. (Zn-Mg), systems with incongruent M.P. (Na-K), Applications of above Systems.

Unit-3 :

Water & its treatment : Part I – Sources of water, impurities in water, hardness of water and its determination, units of hardness, alkalinity of water and its determination, Related numerical problems, scale and sludge formation (composition properties and methods of prevention).

Unit-4 :

Water and its treatment : Part II – Treatment of water for domestic use, coagulation, sedimentation, filtration and dis-infection, water softening, Ion-exchange process, mixed bed demineralisation, Desalination (reverse osmosis) (electrodialysis).

Unit-5:

Corrosion and its prevention - Galvanic & concentration cell, Dry and wet corrosion, Electrochemical theory of corrosion, Galvanic corrosion, pitting corrosion, water-line corrosion, differential aeration corrosion, stress corrosion, factors affecting corrosion, Preventive measures (proper design, Cathodic protection, protective coatings).

Unit-6:
Lubrication and Lubricants - Friction, mechanism of lubrication, classification and properties of lubricants, Additives for lubricants, synthetic lubricants, Greases – Preparation & properties (consistency, drop point) and uses.

Unit-7:

Polymers and Polymerization - Organic polymers, polymerisation, various types of polymerisation, effect of structure on properties of polymers,

preparation properties and technical applications of thermo-plastics (PVC,PVA), thermosets
(PF,UF), and elastomers (SBR,GR-N), Silicones, Introduction to polymeric compsites.

Unit-8 :

Analytical Methods - Thermal methods, Principle, method and application of Thermogravimetric analysis, Differential thermal analysis and Differential scanning calorimetry , (Experimental details are excluded),Spectroscopic methods, Spectrophotometry, interaction of E.M. radiations with a molecule and origin of spectrum, spectroscopic, techniques-vibrational and electronic spectroscopy (Experimental details are excluded), conductometric titration, elementary discussion on Flame-photometry.

NOTE: Eight questions are to be set with a fair weightage of all the units. The candidates will be required to attempt five questions in all.

TEXT BOOKS :

1. Engineering Chemistry, P.C. Jain, Monica Jain (Dhanpat Rai & Co.).
2. Chemistry in Engineering & Tech., Vol.I & II, Rajaram, Kuriacose (TMH).

REFERENCE BOOKS :

1.   Instrumental methods of Chemical Analysis, MERITT & WILLARD (East-West Press).
2. Physical Chemistry, P.W. Atkin (ELBS, Oxford Press).
3. Physical Chemistry, W.J. Moore (Orient-Longman).

ANATOMY & PHYSIOLOGY-I (BME-101)

Credits-4   L-3 Hours/week
                                                             T- 2 Hours/week

PART-A (ANATOMY)

INTRODUCTION:

1. Anatomical position, terminology, regions and planes.
2. Cell Biology: As a unit of the body.
3. Tissues of the body.
4. Organs of the body
5. Gastrointestinal System
6. Respiratory System
7. Circulatory System
8. Urinary System
9. Reproductive System I: Male
10. Reproductive System II : Female

PART-B (PHYSIOLOGY)

HUMAN BODY AS A WHOLE:
Introduction – Internal environment, Homeostatic Balance, Positive and Negative feedbacks, system physiology, survival needs (oxygen, water and foods), metabolism (not in detail).

ORGANIZATION OF HUMAN BODY:
Cells, tissues, organs and systems, Basic anatomy and physiology of cells Tissues (epithelial, connective, muscle, nervous, blood, glands), Systemic anatomy (general), skeleton, bones of skeleton, Disorders of cells and tissues, Permeability of cell membrane, genesis of membrane potential excitation of cell.

ELECTROLYTES AND BODY FLUIDS:
Atoms, molecules, compounds; atomic structure, moleculer weight, hydrogen ion concentration (pH), Buffer system, Acid base balance. Body fluids; extra cellular, Intracellular, interstitial; Principles of transport process and membrane phenomena in biological water transport, body electrolyte and electrolyte transport.

THE BLOOD:
Composition of blood, plasma, blood counts, cell counts, ESR, Immunity (Cellular and Humoral), Erythropoisis, Leukopoisis, Blood groups, Blood donation, Blood Bank, Coagulation, Blood disorders, Anemia, hemorrhage.

CIRCULATORY SYSTEM:
Physiology of heart and blood vessels (arteries and veins) Blood flow, Blood Pressure, systemic and pulmonary circulation, Cardiac output, pulse, ECG, Heart sounds.

LYMPHATIC SYSTEM:

Lymph vessels, anatomy and function, Lymph nodels, and function Spleen and thymus gland.

DIGESTIVE SYSTEM:

Basic principles of nutrition (carbohydrates, proteins, fats, vitamins, minerals) Organs of digestive system: alimentary canal, liver, pancreas, Digestion – in the mouth stomach (gastric juice), small intestine (success enteric-us) pancreatic juice and bile. Absorption – α utilization of nutrients, excretion. Diseases – Inflammation, indigestion, Diarrhea, Appendicitis, Obstruction, Tumors, Liver diseases.

BOOKS
1. Text book of Anatomy Vol. 1,2,3 by Dr. I.B. Singh
2. Grant's Book of Anatomy.
3. Human Anatomy and Physiology by TorTora.

PHY-103-E : **PHYSICS LAB.-I**
(COMMON FOR ALL BRANCHES)

Credits-1.0   P- 2 Hours/week

LIST OF EXPERIMENTS

The experiments in Ist semester will be based mainly upon optics, electrostatics, wave and oscillations which are the parts of the theory syllabus of Ist semester.

1. To find the wavelength of sodium light by Newton's rings experiment.
2. To find the wavelength of sodium light by Fresnel's biprism experiment.
3. To find the wavelength of various colours of white light with the help of a plane transmission diffraction grating.
4. To find the refractive index and Cauchy's constants of a prism by using spectrometer.
5. To find the wavelength of sodium light by Michelson interferometer.
6. To find the resolving power of a telescope.
7. To find the pitch of a screw using He-Ne laser.
8. To find the specific rotation of sugar solution by using a polarimeter.
9. To compare the capacitances of two capacitors by De'sauty bridge and hence
     to find the dielectric constant of a medium.
10. To find the flashing and quenching potentials of Argon and also to find the
     capacitance of unknown capacitor.
11. To study the photoconducting cell and hence to verify the inverse square law.
12. To find the temperature co-efficient of resistance by using platinum resistance thermometer and Callender and Griffith bridge.
13. To find the frequency of A.C. mains by using sonometer.
14. To find the velocity of ultrasonic waves in non-conducting medium by Piezo-electric method.

RECOMMENDED BOOKS:

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint (KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

Note : Students will be required to perform atleast 10 experiments out of the list in a semester.

ME- 107 E   **WORKSHOP PRACTICE**

Credits-2.0   P- 4 Hours/week

LIST OF EXPERIMENTS / JOBS

1.   To study different types of measuring tools used in metrology and determine least counts of vernier calipers, micrometers and vernier height gauges.

2.   To study different types of machine tools (lathe, shape or planer or slotter, milling, drilling machines)

3.   To prepare a job on a lathe involving facing, outside turning, taper turning, step turning, radius making and parting-off.

4.   To study different types of fitting tools and marking tools used in fitting practice.

5.   To prepare lay out on a metal sheet by making and prepare rectangular tray, pipe shaped components e.g. funnel.

6.   To prepare joints for welding suitable for butt welding and lap welding.

7.   To perform pipe welding.

8.   To study various types of carpentry tools and prepare simple types of at least two wooden joints.

9.   To prepare simple engineering components/ shapes by forging.

10.   To prepare mold and core assembly, to put metal in the mold and fettle the casting.

11.   To prepare horizontal surface/ vertical surface/ curved surface/ slots or V-grooves on a shaper/ planner.

12.   To prepare a job involving side and face milling on a milling machine.

NOTE : 1.   At least ten experiments/ jobs are to be performed/ prepared by students in the semester.

        2.   At least 8 experiments/ jobs should be performed / prepared from the above list, remaining two may either be performed/ prepared from the above list or designed & set by the concerned institution as per the scope of the syllabus of Manufacturing Processes and facilities available in the Institute.

CYP-103 :   **CHEMISTRY-I LAB**
                         (COMMON FOR ALL BRANCHES)
Credits-1.0   P- 2 Hours/week
                         LIST OF EXPERIMENTS

1. Determination of Ca^{++} and Mg^{++} hardness of water using EDTA solution.

2. Determination of alkalinity of water sample.

3. Determination of dissolved oxygen (DO) in the given water sample.

4. To find the melting & eutectic point for a two component system by using method of cooling curve.

5. Determination of viscosity of lubricant by Red Wood viscometer (No. 1 & No. 2).

6. To determine flash point & fire point of an oil by Pensky - Marten's flash point apparatus.

7. To prepare Phenol-formaldehyde and Urea formaldehyde resin.

8. To find out saponification No. of an oil.

9. Estimation of calcium in lime stone and dolomite.

10. Determination of concentration of $KMnO_4$ solution spectrophotomet-erically.

11. Determination of strength of HCl solution by titrating it against NaOH solution conductometerically.

12. To determine amount of sodium and potassium in a, given water sample by flame photometer.

13. Estimation of total iron in an iron alloy.

Note :   At least ten experiments are to be performed by the students.

SUGGESTED BOOKS :
1.   A Text Book on Experimental and Calculation - Engineering Chemistry, S.S. Dara, S. Chand & Company (Ltd.)
2.   Essential of Experimental Engineering Chemistry, Shashi Chawla, Dhanpat Rai Publishing Company.
3.   Theory & Practice Applied Chemistry – O.P. Virmani, A.K. Narula (New Age)

CSE -103 E   **C PROGRAMMING LAB.**

Credits-1.0   P- 2 Hours/week

  Representative programming problems:-

1. Write a program to find the largest of three numbers. (if-then-else)
2. Write a program to find the largest number out of ten numbers (for-statement)
3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).
4. Write a program to find roots of quadratic equation using functions and switch statements.
5. Write a program using arrays to find the largest and second largest no. out of given 50 nos.
6. Write a program to multiply two matrices
7. Write a program to read a string and write it in reverse order
8. Write a program to concatenate two strings
9. Write a program to sort numbers using the Quicksort Algorithm.
10. Represent a deck of playing cards using arrays.
11. Write a program to check that the input string is a palindrome or not.

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

ANATOMY & PHYSIOLOGY-I LAB (BTBM-130)

Credits-1.0   P-2 Hours/week

SECTION A (ANATOMY)

THROUGH SLIDE/DEMONSTRATION AND CHARTS
1. Introduction : Anatomical Position, terminology, regions and planes etc.
2. Cell Biology: As a unit of the body.
3. Tissues of the body
4. Organs of the body
5. Skeletal System : Appendicular skeletal
6. Skeletal System : Axial skeletal
7. Muscular System I
8. Muscular System II
9. Gastrointestinal System
10. Respiratory System
11. Circulatory System
12. Urinary System
13. Reproductive System I : Male
14. Reproductive System I : Female

SECTION B (PHYSIOLOGY)
1. Microscopy – Blood (Haemogram) RBC, WBC, Hb, ESR, Differential Counts, Identification of cells.
2. Kymograph – Recording of resting membrane potential, action potential – Demonstration.
3. Muscle contraction and effect of drugs-Demonstration.
4. B.P. Monitoring
5. Bleeding Time
6. Clotting Time

3-4 Visits to a Medical College for Cadaver Exposure.

GURU JAMBHESHWAR UNIVERSITY, HISAR
II SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total Credits
HUM-102-E	Communication skill in English	3	1	-	3.5
MATH-102-E	Mathematics-II	3	2	-	4.0
PHY-102-E	Physics-II	3	1	-	3.5
CYL-201	Chemistry-II	3	1	-	3.5
BME-104	Anatomy & Physiology-II	3	2	-	4.0
EE-101-E	Electrical Technology	3	1	-	3.5
PHY-104-E	Physics-II Lab	-	-	2	1.0
CYP-203	Chemistry- II Lab	-	-	2	1.0
ME-105-E	Engineering Graphic & Drawing	1	-	4	3.0
BME-108	Anatomy & Physiology-II Lab	-	-	2	1.0
EE-103-E	Electrical Technology Lab	-	-	2	1.0
	Total	19	8	12	29

PROPOSED NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

HUM-102-E   **COMMUNICATION SKILLS IN ENGLISH**
(COMMON FOR ALL BRANCHES)

L-3   T-1
Total Credits-3.5

This course is designed for the students of Engineering and Technology who need English for specific purposes in specific situations. It aims at imparting the communication skills that are needed in their academic and professional pursuits. This is achieved through an amalgamation of traditional lecture-oriented approach of teaching with the task based skill oriented methodology of learning.

COURSE CONTENT

Unit-I
Communicative Grammar: Spotting the errors pertaining to nouns, pronouns, adjective and adverbs; Concord - grammatical concord, notional concord and the principle of proximity between subject and verb.

Unit-II
Lexis: Idioms and phrases; Words often confused; One-Word Substitutes; Formation of words (suffixes, prefixes and derivatives); Foreign Words (A selected list)

Unit-III
Oral Communication:

Part-A: Introduction to principal components of spoken English – Word-stress patterns, Intonation, Weak forms in English

Part-B: Developing listening and speaking skills through various activities, such as (a) role play activities, (b) Practising short dialogues (c) Group discussion (d) Debates (e) Speeches (f) Listening to news bulletins (g) Viewing and reviewing T.V. programmes etc.

Unit-IV
Written Communication:

Developing reading and writing skills through such tasks/activities as developing outlines, key expressions, situations, slogan writing and theme building exercises

Reading verbal and non-verbal texts-like cartoons, Graphs and tabulated data etc.

Unit-V (For Internal Evaluation Only):
Book Review – Herein the students will be required to read and submit a review of a book (Literary or non-literary) of their own choice. This will be followed by a presentation of the same in the clUnit-VI

Technical Writing:
(a) Business Letters, Format of Business letters and Business letter writing
(b) E-mail writing
(c) Reports, Types of Reports and Format of Formal Reports
(d) Press Report Writing

SUGGESTED READING:

1. Language in Use (Upper intermediate Level, Adrian Doff Christopher Jones, Cambridge University Press
2. Common Errors in English, Abul Hashem, Ramesh Publishing House, new Delhi.
3. Objective English, Tata Mc. Graw Hill Publishing Company Ltd., New Delhi.
4. Spoken English for India, R.K. Bansal & J.B. Harrison, Orient Longman, Delhi.
5. The sounds of English, Veena Kumar, Makaav Educational Software, New Delhi.
6. English Phonetics & Phonology, P. Roach, Cambridge University Press, London.
7. English for Engineers and Technologists: A Skill Approach, Vol. 2, Orient Longman,Delhi.
8. Business Communication, M.S. Ramesh and C.C. Pattanshetti, R.Chand and Company, Delhi
9. Group Discussion, Sudha Publications/Ramesh Publishing House, New Delhi.

SCHEME OF EXAMINATION:
All questions will be compulsory and will cover all the aspects of the syllabus except unit V. There will be sufficient internal choice.

Unit-I: 20 Marks

Questions No. 1 will require the students to carefully read the sentences given and trace the errors, if any, and then suggest the correct alternatives/answers.

Unit-II: 20 Marks

Question No. 2 may have four or five parts testing knowledge of different items of vocabulary.

Unit-III: 20 Marks

Question No. 3 will have two parts of 10 marks each from part A and B of the unit. Part A will have content words, form words and sentences for stress marking, transcription and intonation marking respectively. Part B will test students' speaking skills through various oral tasks and activities - debate, group discussion and speech - in written form only.

Note: Speaking and listening skills will primarily be tested orally through internal assessment.

Unit-IV: 20 Marks

Question No. 4 may have many parts. The questions will be framed to test students' composition skills on the elements prescribed in the unit. For example, the students may be required to develop a hypothetical situation in a dialogue form, or to develop an outline, key expression, graph etc.

Unit-V is for internal assessment only.

Unit-VI: 20 Marks

Question No. 5 may have two parts. While the one part may require the students to frame either a press/news report for the print media or write the given business letter, or e-mail a message, the second part will have a theory question on the format of formal report and business letter.

MATH-102-E   **MATHEMATICS-II**
                          (COMMON FOR ALL BRANCHES)
L-3   T-2
Total Credits-4.0   **PART-A**

Matrices & its Applications : Rank of a matrix, elementary transformations, elementary matrices, inverse using elementary transformations, normal form of a matrix, linear dependence and in dependence of vactors, consistency of linear system of equations, linear and orthogonal transformations, eigen values and eigen vectors, properties of eigen values, Cayley - Hamilton theorem and its applications.

PART-B

Ordinary Differential Equations & its Applications : Exact differential equations. Equations reducible to exact differential equations. Applications of Differential equations of first order & first degree to simple electric circuits, Newton's law of cooling, heat flow and orthogonal trajectories.

Linear differential equations of second and higher order. Complete solution, complementary function and particular integral, method of variation of parameters to find particular Integral, Cauchy's and Legender's linear equations, simultaneous linear equations with constant co-efficients. Applications of linear differential equations to simple pendulum, oscillatory electric circuits.

PART-C

Laplace Transforms and its Applications : Laplace transforms of elementary functions, properties of Laplace transforms, existence conditions, transforms of derivaties, transforms of integrals, multiplication by t^n, division by t. Evaluation of integrals by Laplace transforms. Laplace transform of Unit step function, unit impulse function and periodic function. Inverse transforms, convolution theorem, application to linear differential equations and simultaneous linear differential equations with constant coefficients.

Partial Differential Equations and Its Applications : Formation of partial differential equations, Lagrange's linear partial differential equation, First order non-linear partial differential equation, Charpit's method. Method of separation of variables and its applications to wave equation and one dimensional heat equation, two dimensional heat flow, steady state solutions only.

TEXT BOOKS :
1. Advanced Engg. Mathematics F Kreyszig
2. Higher Engg. Mathematics B.S. Grewal
REFERENCE BOOKS :
1. Differential Equations – H.T.H. Piaggio.
2. Elements of Partial Differential Equations – I.N. Sneddon.
3. Advanced Engineering Mathematics – R.K. Jain, S.R.K.Iyengar.
4. Advanced Engg. Mathematics – Michael D. Greenberg.

Note: Examiner will set eight questions, taking two from Part-A, three from Part-B and three from Part-C. Students will be required to attempt five question taking atleast one from each part.

PHY-102-E : **PHYSICS-II**
(COMMON FOR ALL BRANCHES)
L-3   T-1
Total Credits-3.5   **PART-A**

CRYSTAL STRUCTURE

Space Lattice, unit cell and translation vectors, Miller indices, simple crystal structure, Bonding in solids, Experimental x-ray diffraction method, Laue method, powder Method, Point defects in solids, Elementary idea of quarks and gluons.

QUANTUM PHYSICS

Difficulties with Classical physics, Introduction to quantum mechanics-simple concepts, discovery of Planck's constant, Group velocity and phase velocity, Schrodinger wave equations - time dependant and time independent Schrodinger equations, Elementary ideas of quantum statistics.

FREE ELECTION THEORY

Elements of classical free electron theory and its limitations, Drude's Theory of Conduction, quantum theory of free electrons, Fermi level, Density of states, Fermi-Dirac distribution function, Thermionic emission, Richardson's equation.

PART-B

BAND THEORY OF SOLIDS

Origin of energy bands, Kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Concept of effective mass and holes, Classification of solids into metals, Semiconductors and insulators, Fermi energy and its variation with temperature. Hall effect and its Applications.

PHOTOCONDUCTIVITY AND PHOTOVOLTAICS

Photoconductivity in insulating crystals, variation with illumination, effect of traps, applications of photoconductivity,
photovoltaic cells and their characteristics.

MAGNETIC PROPERTIES OF SOLIDS

Atomic magnetic moments, orbital diamagnetism, Classical theory of paramagnetism, ferro magnetism - molecular fields and domains.

SUPER CONDUCTIVITY

Introduction (experimental survey), Meissner effect, London equation.

TEXT BOOKS :
1. Introduction to Solid State Physics (VII Ed.) – Charles Kittel (John Wiley).
2. Quantum Mechanics – Powell and Crasemann (Oxford & IBH)
3. Fundamentals of Solid State Physics – B.S.Saxena, R.C.Gupta and P.N.Saxena (Pragati Prakashan).

REFERENCE BOOKS :
1. Sold State Physics – Pillai (New Age).
2. A text book of Engg. Physics – Avadhanulu and Kshirsagar (S.Chand)
3. Quantum Mechanics – Ghatak & Loknathan.

Note: The Examiners will set eight questions, taking four from each part. The students will be required to attempt five questions in all selecting at least two from each part. All questions will carry equal marks.

Anatomy & Physiology-II (BME-104)

Credits-4
L-3 Hours/week
T-2 Hours/week

PART-A (ANATOMY)

1. Functional aspect of bones and joints
2. Shoulder joint, Elbor joint
3. Radioulnar and wrist joint
4. Joints of hand
5. Hip joint
6. Knee joint
7. Ankle and foot
8. Anatomy of glands Pituitary, Thyroid, Adrenal, Pancreas, Parathyroid
9. Spine: joints of neck
10. Lumbosacral joints, vertebral column, Mechanism of locomotion.
11. CSF circulation
12. Brain and functional areas
13. Autonomic nerves
14. Eye and ear
15. Mandible, Dental Archades
16. Para nasal sinuses
17. Coronary circulation
18. Abdominal Wall and inguinal region
19. Structure of skin.

PART-B (PHYSIOLOGY)

NERVOUS SYSTEM:

Nerve impulse, action potential, receptors, reflex action, bioelectric phenomena. Brain; mid brain, pons Medulla Cerebellum and functional areas, sensory motor areas, vital centres in medulla, reticular formation, hypothalamus, Autonomic nervous system (sympathetic and parasympathetic), Disease of CNS, Nerve damage, CSF obstructions, Head injuries, stroke, brain tumor, dementia, motor neuron disease.

SPECIAL SENSES:

Eye-Physiology of sight, Ear-Physiology of hearing and physiology of balance, smell and taste.

ENDOCRINE SYSTEM:

Functions of Thyroid, Pituitary, Adrenals, Pancreas, Parathyroid.
Diseases-Hypertension, Diabetes, Hypo and Hyperthyroidism, Cretinism, myxodems.

RESPIRATORY SYSTEM:
        Functions of lungs, Airways, Bronchi, Bronchiole, Physiology of Respiration, O2 Transport and CO2 elimination, Respiratory Regulation.

URINARY SYSTEM:
        Functions-Formation of urine (filtration, selective reabsorption, secretion) composition of the urine, urine analysis, water and electrolyte balance. Disease of urinary system nephritis, Hypertension, Nephrotic syndrome, renal failure, renal calculi. Transplantation, dialysis.

SKIN:
        Function of the skin-protection, temperature regulation, Vitamin D Synthesis. Wound healing, Disorders of the skin-infection eczema, dermatitis, burns, tumors

BOOKS:
1. Clinical anatomy by Snell
2. Concise medical physiology by Chaudhary
3. A text book of Human Anatomy by Grant

REFERENCE BOOKS:
1. Gray's book of Human Anatomy
2. Text book of Human Physiology by Guyton

EE-101-E   **ELECTRICAL TECHNOLOGY**

L-3   T-1

Total Credits-3.5

UNIT1. D.C. CIRCUITS:

Ohm's Law, Kirchoff's Laws, D.C. Circuits, Nodal and Loop methods of analysis.

UNIT2.

a) A.C. CIRCUITS:

Sinusoidal signal, instantaneous and peak values, RMS and average values, phase angle, polar & rectangular, exponential and trigonometric representations; R,L and C components, behaviors of these components in A.C. circuits. Concept of complex power, power factor.

b) TRANSIENT RESPONSE:

Transient response of RL, RC and RLC Circuits with step input.

UNIT3. NETWORK THEOREMS:

Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transfer theorem, Reciprocity theorem, Tellegen's theorem, Milman's theorem. Star to Delta & Delta to Star transformation.

UNIT4. SERIES AND PARALLEL A.C. CIRCUITS:

Series and parallel A.C. circuits, series and parallel resonance, Q factor, cut-off frequencies and bandwidth.

UNIT5. THREE PHASE CIRCUITS:

Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by two wattmeter method, Importance of earthing.

UNIT6. TRANSFORMERS:

Principle, construction & working of transformer, Efficiency and regulation.

UNIT7. ELECTRICAL MACHINES:

Introduction to D.C. Machines, Induction motor, Synchronous machines.

UNIT8. MEASURING INSTRUMENTS:

Voltmeter, Ammeter, Watt meter, Energy meter.

TEXT BOOKS:

1. Basic Electrical Engg (2nd Edition): Kothari & Nagarath, TMH
2. Electrical Technology (Vol-I): B.L Theraja & A K Theraja, S.Chand

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals: Deltoro, PHI
2. Network Analysis: Valkenburg, PHI

NOTE: Eight questions are to be set in all by the examiner taking at least one question from each unit. Students will be required to attempt five questions in all.

PHY-104-E :   **PHYSICS LAB.-II**
P-2   (COMMON FOR ALL BRANCHES)
Credit-1.0

LIST OF EXPERIMENTS

The experiments in Second semester will be based upon electricity, Magnetism, Modern Physics and Solid State Physics which are the parts of theory syllabus.

1. To find the low resistance by carey - Foster's bridge.
2. To find the resistance of a galvanometer by Thomson's constant diffelction method using a post office box.
3. To find the value of high resistances by Substitution method.
4. To find the value of high resistances by Leakage method.
5. To study the characteristics of a solar cell and to find the fill factor.
6. To find the value of e/m for electrons by Helical method.
7. To find the ionisation potential of Argon/Mercury using a thyratron tube.
8. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
9. To study the characteristics of (Cu-Fe, Cu-Constantan) thermo couple.
10. To find the value of Planck's constant by using a photo electric cell.
11. To find the value of co-efficient of self-inductance by using a Rayleigh bridge.
12. To find the value of Hall Co-efficient of semi-conductor.
13. To study the V-I characteristics of a p-n diode.
14. To find the band gap of intrinsic semi-conductor using four probe method.
15. To calculate the hysteresis loss by tracing a B-H curve.

RECOMMENDED BOOKS :

1. Advanced Practical Physics – B.L. Worshnop and H.T. Flint KPH)
2. Practical Physics – S.L.Gupta & V.Kumar (Pragati Prakashan).
3. Advanced Practical Physics Vol.I & II – Chauhan & Singh (Pragati Prakashan).

Note : Students will be required to perform atleast 10 experiments out of the list in a semester.

ME-105 E   **ENGINEERING GRAPHICS   AND   DRAWING**

L:1 P:2

Credit:3.0

Unit I   Various   types   of   projections, First and Third angle systems of orthographic projections. Projection of Points in different quadrants.

Unit II   Projections of Straight Lines – parallel to one or both reference planes, contained by one or both planes, perpendicular to one of the planes, inclined to one plane but parallel   to the other planes, inclined to both the   planes, true length of a line and   its inclination with reference planes, traces of a line.

Unit III   Projections of Planes – parallel   to one reference plane, inclined to one plane but perpendicular to the other, inclined to both reference planes.

Unit IV   Projections of Polyhedra   Solids and Solids of Revolution - in simple positions with axis perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined   to the   other, Projections of sections of Prisms,   Pyramids, Cylinders and Cones. True shape of section.   Development of surfaces of various solids.

Unit V   Isometric projections - introduction, isometric scale, Isometric views   of plane figures, prisms, pyramids and cylinders.

Unit VI   Orthographic drawings of Bolts and Nuts, Bolted Joints,   Screw threads, Screwed Joints.

Unit VII   Free   Hand   Sketching - Orthographic Views   from   Isometric, Views of Simple Machine Components such as Brackets,   Bearing Blocks , Guiding Blocks   and Simple Couplings.

Note :   Some simple exercises may be attempted with AUTOCAD.

Text Book

1.   Engineering Drawing Plane and Solid Geometry :   N.D. Bhatt and V.M.Panchal, Forty-Fourth Edition 2002, Charotar Publishing House.

Reference Books

1.   Engineering Graphics and Drafting : P.S. Gill, Millennium Edition,   S.K. Kataria and Sons.
2.   A Text Book of Engineering Drawing : S.B. Mathur, Second Revised and Enlarged Edition 2000, Vikas Publishing House.
3. Engineering Graphics using AUTOCAD 2000 : T. Jeyapoovan, First Edition 2002, Vikas Publishing House.

Anatomy & Physiology-II-I LAB (BME-108)

Credits-1   **P-2 Hours/week**

PART-A (ANATOMY)

THROUGH DEMONSTRATION AND CHARTS:

Functional aspect of bones and joints
Shoulder joint, Elbor joint
Radioulnar and wrist joint
Joints of hand
Hip joint
Knee joint
Ankle and foot
Spine: joints of neck
Lumbosacral joints, vertebral column, Mechanism of locomotion.
CNS,CSF circulation
Functional areas of CNS
Autonomic nerves
Eye and ear
Mandible, Dental Archades
Para nasal sinuses
Coronary circulation
Abdominal Wall and inguinal region
Testing of various Cranial nerve.

PART-B (PHYSIOLOGY)

MEASUREMENTS RECORDING AND ANALYSIS:

ECG-Recording, Analysis
To teach about various systems with the help of Models: Respiratory System,
Urinary system, excretory System, Heart, Eye, Nose, Skin
To teach about diff. Reflexes of the body.

Some regions may be demonstrated in cadaver's parts/living body.

EE-103-E   **ELECTRICAL TECHNOLOGY LAB**

P-2 Hours/week
CREDIT:1

LIST OF EXPERIMENTS

1. To verify KCL and KVL.

2. To verify Thevenin's & Norton's Theorems.

3. To Verify maximum power transfer theorem   in D.C. Circuit & A.C circuit.

4. To verify reciprocity & Superposition theorems.

5. To study frequency response of a series R-L-C circuit and determine resonant frequency& Q-factor for various Values of R, L, and C.

6. To study frequency response of a parallel R-L-C circuit and determine resonant frequency & Q - Factor for various values of R, L, and C.

7. To perform direct load test of a transformer and plot efficiency Vs load characteristic.

8. To perform direct load test of a D.C. shunt generator and plot load voltage Vs load current curve.

9. To plot V-curve of a synchronous motor.

10. To perform O.C. and S.C. tests of a three phase induction motor.

11. To study various type of meters.

12. Measurement of power by 3 voltmeter / 3 ammeter method.

13. Measurement of power in a 3 phase system by two watt meter method.

NOTE: 1. At least 10 experiments are to be performed by students in the semester.
        2. At least 7 experiments should be performed from the above list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus of EE-101-E.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
III SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
MATH-201-E	Mathematics-III	3	2	-	4.0
BME-201	Histology	3	1	-	3.5
BME-203	Electronic Devices And Components	3	1	-	3.5
BME-205	Analog Electronics-I	3	1	-	3.5
BME-207	Biochemistry	3	1	-	3.5
BME-209	Signals & Systems	3	1	-	3.5
BME-211	Histology Lab	-	-	2	1.0
BME-213	Analog Electronics-I Lab	-	-	3	1.5
BME-215	Biochemistry Lab	-	-	2	1.0
	Total	18	7	7	25.0

PROPOSED NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

Histology (BME-201)

Credits-3.5   **L-3 Hours/week**
                                               T-1 Hours/week

PART-A (GENERAL HISTOLOGY)

The structure of cell, organelles and inclusion bodies.
Cell Division.
The epithelium, definition, classification and modification of epithelia.
Classification of glands.
The connective tissue: definition and classification of connective tissues. The embryological and
    adult forms of connective tissues.
Specialized connective tissue; the reticular, adipose and pig-mented connective tissues.
Cartilage; structure and different type of cartilages.
General histology of the bone
Histology of blood cells.
The muscular tissue; various types, their characterization and identification under microscope.
Ner4vous tissue, different types of neurons nerve fibers and glacial cells.
Histological structures of cerebral cortex. Spinal ganglion and autonomic ganglion

PART-B (SYSTEMATIC HISTOLOGY)

Histology of the lips, cheek, teeth and tongue.
Histology of thepharynx, oesophagus and stomach.
Histology of theintenstine and salivary glands.
Histology of the Liver and Pancreas.
Histology of various divisions of the nasal cavity, larynx, trachea and bronchi.
Histology of bronchus, bronchioles, respiratory structure of lung and blood air barrier.
Histology of the kidney, ureter and urinary bladder
Histology of the testis and ducts of the male gential system.
Histology of the penis and accessory genitai glands.
Histology of the female genital glands, ovary, Fallopian tubes, uterus, vagina vulva.
Histology of mammary glands and adrenal glands.
Histology of thyroid and parathyroid glands.
Histology of the thymus, spleen and lymph glands.
Histology of heart and conduction system.
Histology of arteries, veins and lymphatic.

BOOKS:-

A text book of Human Histology by I.B.Singh.
Wheatier functional Histology by B.Yound
Text book of Histology by Bloom & Fwwcett.

Electronic Devices and Components (BME-203)

Credits-3.5

L-3 Hours/week

T-1 Hours/week

INTRODUCTION TO BASIC COMPONENTS:

Resistance, capacitance, inductance and their color codes RL, RC, RLC, Circuits, series and parallel circuits, integrated circuits, potentiometers, ammeters, voltmeters, watt meters, energy meters, Fabrication of diodes, transistors-various techniques.

SEMICONDUCTOR DIODE

Diodes, transistors (BJT, UJT, FET, MOSFET), Power Transistors (Basic construction and characteristics). Zener, Varactor, Schottky, Power, Tunnel Photo and light emitting diodes. Application of diodes, transistors and op-amps, thyris.ors, LCDs, Solar Celle, photo transistors, display deivces and photo sensitive devices, microwave devices-tunnel diode, transistor IMPATT, TRAPATT, GUNN, semiconductor lasers.

ELECTRONICS INSTRUMENTS & MEASUREMENTS

Electronic voltmeter-differential, peak reading, average reading, true rms reading. Digital voltmeters (DVM), Frequency meters-analog and digital types, analog and digital multi-meter, phase meters: analog and digital types.

CRO-black diagram controls time base, triggering considerations, measurement of amplitude frequency lissajous figures-use in phase and frequency measurements, dual trace, multi trace, dual beam, sampling, storage, digital oscilloscope, use of CRO in square wave testing of amplifier, digital oscilloscopes, signal generator/function generator-AF,RF and BFO, spectrum analyzers, power meters.

BOOK:-

1. Electronics instruments and Measurement Techniques by Cooper
2. Electronics Instruments by Oliver Cage.
3. Electronics Instrumentation by A.K.Sawney.

Analog Electronics-I (BME-205)

Credits-3.5

L-3 Hours/week
T-1 Hours/week

SEMICONDUCTOR DIODES:
   PN Junction, PN Junction as rectifier, VI characteristics of PN Junction diode, switching times of diodes.

DIODES CIRCUITS:
   Diode as a circuit element, the load line concepts, half wave and full wave rectifier, clipping circuits, filter circuits, peak to peak detector and voltage multiplier circuits, clamping circuit.

TRANSISTOR AT LOW FREQUENCIES:
   Bipolar junction transistors: operations characteristics, Ebers-Moll Model of transistors, Hybrid mode, h-parameters (CE, CB,CC configurations) analysis of a transistor amplifier circuit using h-parameters, Emitter follower, Miller's theorem, Frequency response of R-C coupled amplifier.

TRANSISTOR BIASING:
   Operating point, biased stability fixed bias, voltage divider bias, collector to base bias, self bias, bias compensation, thermistor and sensitor compensations.

TRANSISTORS AT HIGH FREQUENCIES:
   Hybrid-2 model, CE short circuit current gain, frequency response, alpha, cut-off frequency, gain bandwidth product, emitter follower at high frequencies.

FIELD EFFECT TRANSISTOR:
   Junctin field effect transistor, pinch off, volt ampere characteristics, small signal model, MOSFET: Enhancement & Depletion mode, V-MOSFET C-MOS, N-MOS, P-MOS, common source amplifier, source follower, biasing of FET as a voltge variable (VVR) uni-junction Transistor (UJT).

REGULATED POWER SUPPLIES:
   Series and shunt voltage regulators, power supply characteristics, three terminal IC regulators.

TEXT BOOKS:
   1.   Integrated Electronics : Miliman & Halkisa- MeGraw Hill.
REFERENCE BOOKS:
   1.   Electronics Principles : Malvino –McGraw Hill
   2.   Electronics circuits: Donald L. Schiling & Cvharles Belui-MGH
   3.   Electronics Devices & Circuits: Mill Man & Halkias-McGraw Hill
   4.   Electronics Devices & Circuit Theory: Boylestad, Nashelsky-PHI

Biochemistry (BME-207)

Credits-3.5

L-3 Hours/week
T-1 Hours/week

CARBOHYDRATE METABOLISM:
Digestion and absorption of carbohydrates, glycolysis, synthesis and break down of glycogen, citric acid cycle, Blood sugar level and its regulation, diabetes.

PROTEIN MELABOLISM:
Digestion and absorption of roteins, Deamination, transamination, de-carboxylation, Protein synthesis, urea synthesis, Phenylketoauria,parkinsons disease.

LIPID METABOLISM
Beta oxidation, excretion, artherosclerosis, cholestered synthesis and transport (HDL & LDL role).

MINERAL METABOLISM:
Study of calcium and phosphorus, study of sodium, potassium and chloride

WATER AND ELECTROLYTE BALANCE

ACID-BASE BALANCE

CELL SIGNALING AND NECHANISM OF HORMONE ACTION:-
Signal transduction-role of Camp, CGMP, CA, IPS, DAG, Ca homeostatis.

SEPARATION TECHNIQUES:
Salt and Organic solvent fraction; Dialysis, Reverse Dialysis, Ultrafulteration, Reverse osmosis, Chromatograhy various typers eith principles, GLC, HPLC Electrophoresis, principles, SDS, PAGE, Isoelctrohocussing-principle and use Centigugation-various types of centrifuges, density gradient, swedberg constant. Spectroscopy-UV and visible.

RADIOISOTOPES IN BIOLOGY:
Applications and precautions.

IMMUNE RESPONSE-T AND B CELLS:
Innate and acquired immunity, antigens and antibody and specificity, ELISA techniques principle and application.

BOOKS:
1. Text book of Biochemistry- by A.V.S.S.Rao
2. Bio-chemistry by C.V. Pawar. & G.R.Chatwal
3. Essentials of Bio-chemistry by J.L.Farley.

Signals & systems (BME-209)

Credits-3.5   **L-3 Hours/week**
                                              T-1 Hours/week

INTRODUCTION
   Basic Concepts and Definitions and Discrete Time Signals, Systems and their Classification, Basic Signals, LTI Systems: Convolution for Continuous Time (CTS), Convolution for Discrete Time Systems (DTS), Systems Modelling, Differential Equation for DTS.

FOURIER ANALYSIS FOR CTS:-
   Response of LTI systems to Exponential Signals, Periodic Signals, Fourier Series, Fourier Transform and its properties, Syetems analysis by Fourier transforms. Fourier analysis for DTS: Response of LTI systems to exponential signals, Discrete time Fourier series, discrete time Fourier Transform it's properties, DFGT and its properties, systems analysis by Fourier Transforms.

SAMPLING:
   The sampling theorem, effect of under sampling, sampling of Band signals. Laplace Transform; Definition and properties, methods of Inversions, Application (LTI) system analysis.
Z-transform: Definitions and properties, significance of ROC, Inversion of Z-transforms. Application to system analysis.

RANDOM SIGNAL AND SYSTEMS:

   Basic concepts and definitions, distribution and density functions, Mean values and Moments, Case of two Random Variables, random processes, correlation functions and their properties, sum of random processes, spectral density, response of Linear systems of random inputs.

TEXT BOOKS:
  1. Signals & System by Simon Proakins
  2. Signals & System by Oppenheim, Willsky

REFERENCE BOOKS:
  1. Signal & System by Mitra

Histology lab (BME-211)

Credits-1.0   P-2 Hours/week

LIST OF EXPERIMENTS:

1.   Study of compound microscope, its parts.
2.   Demonstration of type of epithelium and gland types.
3.   Demonstration of different types of connective tissue, fibers cells, cartilage and bone.
4.   Histology of the blood smear cells in domestic animals bird.
5.   Histology of the muscular and nervous tissue components
6.   Demonstration of the histological slides of lip, tooth, tongue, salivary glands, oesohagus and stomach.
7.   Demonstration of slides of small intestine, large intestine, liver, pancreas,
8.   Study of the histological slides of nasal cavity, trachea, bronchi and lungs,
9.   Histology slides identification of kidney, ureter, urinary bladder and urethra.
10. Histology of testis, epidiymis, vas deferenc, penis, accessory sex glands.
11. Demonstration of histological slides of ovary, oviduct, uterus, valva, mammary gland.
12. Histology of artery, vein, heart.
13. Demonstration of slides of pituitary gland, pineal gland, thyroid gland, parathyroid gland, adrenal gland, thymus gland, lymphnode and spleen.

Analog Electronics-I Lab (BME-213)

Credits-1.5   P-3 Hours/week

LIST OF EXPERIMENTS:

1. Study of Half wave & full wave rectifiers.
2. Study of power supply filters.
3. Study of Diode as clipper & clamper.
4. Study of Zener diode as a voltage regulator
5. Study of CE amplifier for voltage & current gains and input, output impendence.
6. Study of CC amplifier as a buffer.
7. Study of 3-terminal IC regulator.
8. Study of transistor as a constant current source in CE configuration.
9. Study of FET as a common source amplifier.
10. Study of FET as a common drain amplifier.
11. Graphical Determination of small signal hybrid parameters of bipolar junction transistor.
12. Study & design of a D.C. voltage doubler.

Biochemistry lab (BME-215)

Credits-1.5   **P-3 Hours/week**

LIST OF EXPERIMENTS

1. Study the action of salivary amylase on starch.
2. Study the proteolytic action of trypsin on proteins.
3. Estimatin of gastric juices-pH, acidity test.
4. Estimation of blood glucose by enzymatic method.
5. Estimation of blood urea-enzyme kit method.
6. Estimation of blood cholesterol.
7. Liver function test-serum glutamic oxaloacetic transaminase (i.e.SGOT/ALT).
8. Liver function test-serum glutamic – pyruvic transaminase (i.e. SGPT/APT.
9. Alkaline phosphates test.
10. Estimation of total serum bilirubin.
11. Study abnormal urine contents-bile pigment salts.
12. Visit to clinical laboratories.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
IV SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-202	Biomedical Instrumentation-I	3	1	-	3.5
BME-204	Transducers & Sensors	3	2	-	4.0
BME-206	Digital Circuits and Systems	3	1	-	3.5
BME-208	Analog Electronics-II	3	1	-	3.5
Math-202-E	Numerical Methods	3	1	-	3.5
BME-212	Biomedical Instrumentation-I lab	-	-	3	1.5
BME-214	Transducers & Sensors Lab	-	-	3	1.5
BME- 216	Digital Circuits & Systems Lab	-	-	3	1.5
BME-218	Analog Electronics-II Lab	-	-	3	1.5
Math-204-E	Numerical Methods Lab	-	-	2	1.0
	Total	15	6	14	25.0

Biomedical Instrumentation-I (BME-202)

Credits-3.5   L-3 Hours/week
T-1 Hours/week

MEDICAL INSTRUMENTATION:
Amplifiers, high input impedance, active filters, timers ADC and DAC circuits electrodes and transducers, application in medicine.

BIOMEDICAL TRANSDUCERS & BIOELECTRODES:
Bioelectrodes for ECG (EKG), EEG. EMG, study of ECG in detail as sample case biomedical transducers-pressure, temperature, humidity and moisture, transducers for respiratory measurements, blood pressure measurements (Mercury and Aneroid Types) Skin resistance measurements.

ANALYTICAL INSTRUMENTS:
Common analytical equipment used in hospitals and those in Biochemistry Isboratories, PH meters, Color meter, Glue meter, Bomb cslerimeter, measurements of specific gravity, visceaisty, Autoanalysers, semki autoanalysers, cell counters. Spectromety-UV visible and infared types, Spectrophotometers, Flamephotometers, Densetometers, colourometers, Electrophoresis.

BIOSENSORS AND TRANSDUCERS:-
Biological sensers inhuman body, physiological Monitoring, Need for sensor systems in diagnosis, Biosensors for diagnosis-Ion exchange membrane electrodes.

TEXT BOOKS:-
1.   Handbook of Biomedical Engineering: R.S.Khandpur
2.   Introduction of Analytical Instruments: R.S.Khandpur

TRANSDUCERS & SENSORS (BME-204)

Credits-4.0　　　　　　　　　　　　　　　　**L-3 Hours/week**
　　　　　　　　　　　　　　　　　　　　　　　T-2 Hours/week

1. **Basic Transducer and Principles**
The Transducer and Transduction Principles, Active Transducers, Passive Transducers, Transducers for Biomedical Applications.

2. **Characteristics of the Measurement System**
Transducer and Measurement System, Static Characteristics, Dynamic Characteristics, Standard and Calibration, Accuracy and Error, Types of Error.

3. **Blood Pressure Measurement**
Requirements for Pressure Measurement, Physiological Pressure Range and Measurement Sites, Direct Pressure Measurement, Dynamic Response of Catheter-Transducer Systems, Catheter-Tip Pressure Transducer, Implantable Pressure Transducers and Pressure Telemetering Capsules, Pressure Measurements in Small Vessels, Pressure Measurements in Collapsible Vessels and Interstitial Spaces, Different Pressure Measurements, Indirect Pressure Measurement, Indirect Measurements of Systolic, Diastolic, and Mean Blood Pressure, Indirect Measurements of Instantaneous Arterial Pressure, Internal Pressure Measurements by Reaction Forces.

4. **Blood Flow Measurement**
Requirements for Measurement Ranges, Blood Flow Measurements in Single Vessels, Ultrasonic Blood Flow meter, Ultrasonic Blood Flow meter, Indicator Dilution Method, Flow Velocity Measurements by Heat Dissipation, Blood Flow Recording in Single Vessels by Laser-Doppler Flowmetry, Correlation Methods for Micro vascular Red Blood Cell, Miscellaneous Mechanical Flow meters, Tissue Blood Flow Measurement.

5. **Body Temperature & Heat Flow Measurement**.
Temperature Transducers, Noncontact Temperature Measurement Techniques, Clinical Thermometers, Telemetering Capsules.

6. **Biosensors.**
Enzyme-Based Biosensors, Immunosensors, Microbial Sensors, Chemical Biosensors, Electrochemical Sensors, Chemical Fibro sensors, Ion-Selective Field-Effect Transistor (ISFET), Blood-Glucose Sensors.

Reference:
1.　　Leslie Cromwell, Fred J. Weibell, Erich.A Pfeiffer``Biomedical Instrumentation and Measurements" second Edition published by PEARSON Education.
2.　　Tatsuo Togawa, Toshiyo Tamura, PO.Ake Oberg, ``Biomedical Transducers and Instruments"published by CRC Press Boca Raton, New York.
3.　　John G. Webster, "Medical Instrumentation" third edition, published by John Wiley & Sons (Asia) Pte Ltd.,2 Clementi Loop, Singapore.

Digital Circuits and Systems (BME-206)

Credits-3.5
L-3 Hours/week
T-1 Hours/week

BASIC DIGITAL CIRCUITS:
Digital-signal, logic gates: AND, OR, NOT, NAND,NOR,EX-OR, EX-NOR

NUMBER SYSTEM AND CODES:
Boolean Algebra, Binary, Octal and Hexadecimal number systems. Conversitons from one number system to another, Signed binary number, Sign magnitude, I's complement and 2's complement Binary arithmetic codes BCD, Excess-3, Gray, EBCDIC, Error detection and correction.

COMBINATIONAL CIRCUITS:
Design using gaes, Karnaugh map simplification and Q M method. Multiplexes, Demultiplexers/decoders, Subtractors, BCD arithmetic, Digital encoders, Priority Encoders, Decoder/Drives for display devices, Realization of logic functions using multiplier and demultiplexers.

SEQUENTIAL CIRCUITS:
Flip-flop (S-R, J-K, and D Type), master slave, edge triggered flip flops, shift registers, sequence generators, Counters, Asynchrounours and Synchronous Ring counters and Johnson Counter.

DIGITAL LOGIC FAMILIES:-
Switching mode operating of p-n junction, bipolar and MOS devices, Bipolar logic families :RTL, DTL, DCTL, IIL, TTL, ECL, MOS, and C-MOS logic familie, Tristate logic, interfacing of CMOC and TTL families.

A/D AND D/A CONVERTER:
Dual slope converter, successive approximation converter, Ladder network.

PROGRAMMABLE LOGIC DEVICES:
ROM, PLA, PAL, FPGA

TEXT BOOK:
1.   Digital, Electronic (Edition-II), Dr. R.P.Jain

BOOKS:
1.   Digital Integrated Electronics: Taub & Schilling
2.   Digital Electronics: Malvino Leach

Analog Electronics-II (BME-208)

Credits-3.5   **L-3 Hours/week**
                                                                      T-1 Hours/week

MULTISTAGE AMPLIFIERS:
Classification of amplifiers, distortion in amplifiers, frequency response of an amplifier, step response of a amplifier, band-pass of cascaded stages, RC-coupled amplifier, low frequency response of RC coupled stage; effect of an emitter bypass capacitor on low frequency response & high frequency, multistage CE amplifier.

FEEDBACK AMPLIFIERS:
Feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifiers, input resistance, output resistance, voltage series feedback, current series feedback, current shunt feedback, voltage shunt feedback.

OSCILLATORS:
Sinusoidal oscillators, Barkhausen criteria, R-C phase shift oscillator, general form of oscillator circuit, wien bridge oscillator, crystal oscillator.

POWER AMPLIFIERS:
Class A large signal amplifiers, higher order harmonic distortion, efficiency transformer coupled power power amplifier, class B amplifier, ush-pull amplifiers, efficiency & distortion calculations, class A and B operations, class C power amplifier.

OPERATIONAL AMPLIFIERS:
Ideal operational amplifier, inverting and non-inverting amplifier, differential amplifier, emitter coupled differential amplifier, transfer characteristics of a differential amplifier, offset error voltages and currents, common mode rejection ratio CMRR.

LINEAR APPLICATIONS OF OPERATIONAL AMPLIFIERS:
Inverting & non-inverting amplifiers, scale changer, phase shifter, adder, voltage to current converter, current to voltage converter, DC voltage follower, differential DC amplifiers, Bridge amplifier, AC coupled amplifiers, AC voltage follower, Integrator, differentiator.

NON-LINEAR OPERATIONAL AMPLIFIER APPLICATIONS:
Comparators, sample & hold circuits, Logarithmic amplifier, anti-log amplifiers, logarithmic multiplier, wave from generators, Millar & bootstrap sweep generators, regenerative comparator (Schmitt Trigger), multi vibrators, ADC.

TEXT BOOK:
1.   Integrated Electronics: Milman Halkis, TMII.
REFERENCE BOOKS:
1.   Operational Amplifier: Gayekwad.

MATH-202-E   **NUMERICAL METHODS**

(COMMON FOR BME,ECE & ELECTIVE FOR CSE, IT)   L   T   P
CREDIT: 3.5 (3 -1   – 0)

<u>Interpolation and curve fitting :</u>   Interpolation   problem,   Lagrangian polynomial, Divided difference, Interpolating with a cubic spline, Bezier curves and E-spline curves, Least square approximations.

<u>Non-Linear Equations:</u>   Bisection method, Linear Interpolation methods, Newton's method, Muller's method, fixed-point method.

<u>Simulation Linear Equations:</u> Elimination method, Gauss and Gauss-Jordan method, Jocobi's method, Gauss-seidal method, Relaxation method.

<u>Numerical Differentiation and Intergration:</u> Derivatives   from   differences tables, Higher order derivatives, Extrapolation techniques, Newton-cotes integration formula, Trapezoidal rule, Simpson's rule, Boole's rule and Weddle's rule, Romberg's integration.

<u>Numerical Solution of Ordinary Differential Equations:</u> Taylor series method, Euler and modified Euler method, Runge-Kutta methods, Milne's method, Adams-Moulton method, Power method for Eigen values by iteration.

<u>Numerical Solution of Partial Differential Equations:</u>   Finite   difference approximations of partial derivatives, solution of Laplace equation (standard 5-point formula only), One-dimensional heat equation (Schmidt method, Crank-Nicolson method, Dufort and Frankel method) and wave equation.

BOOKS SUGGESTED :

1.   Applied Numerical Analysis: Curtis F. Gerald and Patrick G. Wheatley, Person, Education Ltd.
2.   Numerical Method: E. Balagurusamy, T.M.H.
3.   Numerical methods for Scientific and Engg. Computations: M.K. Jain, S.R. L. Lyenfer and R.K. Jain, Wiley Eastern Ltd.
4.   Introductory methods of Numerical Analysis: S.S. Sastry, P.H.D.
5.   Numerical Methods in Engg. & Science: B.S. Grewal

Biomedical Instrumentation-I lab (BME-212)

Credits-1.5   **P-3 Hours/week**

NOTE: At least seven experiments are to be performed.

LIST OF EXPERIMENTS:

1.   Measurement of waveform, amplitude, durations and frequency using CRO, triggering of beam with an external signal
2.   Demonstration of optics of simple microscopes, illustrations and function.
3.   Calculation of magnificatgion.1
4.   Demonstration of electron microscope and illustration of electronic parts, function and assembly
5.   Demonstration of various types of transducer and their maintenance.
6.   To set up an animal experiment and measure pressure, temperature etc. using transducers-demonstration.
7.   Demonstration of an auto analyzer, illustration of parts and functions.

Visit to the near by Hospitals/Institutes can be made for demonstration.

Transducer & Sensors Lab (BME-214)

Credits-1.5   P-3 Hours/week

1.   Indirect Method of Blood Pressure Measurement.

2.   Study of Characteristics of Various Temperature Sensors
        a)   Thermister
        b)   Thermocouple
        c)   P- n Junction Diodes & Transistors

3.   Measurement of Stress/Strain using strain gauges.

4.   Study of EEG Signal, to measure the amplitude frequency & nature of EEG.

5.   Measurement of Heart Rate using heart rate monitor.

6.   Using the respiration rate indicator & simulator, measure the rate signal response, Gain of amplifier difference between original & simulated signal.

7.   Study of the Galvanic Skin Resistance system.

8.   Study of Respiratory System & Measurement of Rate & Signal of respiration.

Digital Circuits & Systems lab (BME-216)

Credits-1.5   P-3 Hours/week

List of experiments:

1. To study of TTL gates-AND, OR NOT, NAND, NOR EX-OR.
2. Design & realize a given function using K-maps verify its performance
3. To verify the operation of multiplexes & Demultiplexer.
4. To verify the operation of computer.
5. To verify the truth tables of S-R, J-K, T & D type flip-flops.
6. To verify the operation of bi-directional shift register.
7. To design & verify the operation of 3 bit synchronous counter.
8. To verify the operation of UP/down counter & derive a seven segment display using the same.
9. To design & realize a sequence generator for a given sequence using J-K, flip flop
10. Study of Ring counter.
11. Study of Johnson Counter.

Analog Electronics-II Lab (BME-218)

Credits-1.5   **P-3 Hours/week**

NOTE: At lease eight experiments are to be performed.

LIST OF EXPERIMENTS:-

1. Characteristics of PN junction Zener Diode.
2. CE,CB,CC transistor characteristics, determination of h-parameters using static characteristics of a transistor in CE,CB,CC mode.
3. Characteristics of FET/MOSFET parameter calculation.
4. Characteristics of UJT, calculation of intrinsic stand off ratio.
5. Characteristics of photo diode and photo transistor.
6. Fixing of operating point and performance characteristics (Gain, input and output impedance)
   - R-C coupled amplifier
   - Transformer coupled amplifier
   - Emitter follower

7. Study of Oscillator-Hartley
8. Study of Colpitts
9. Study of RC Oscillators using transistor

NUMERICAL METHODS LAB
(COMMON FOR BME, ECE, ELECTIVE FOR CSE, IT)

MATH-204-E

L   T   P

CREDIT: 1(0-   0 -   2)

WRITE DOEN AND EXECUTE THE FOLLOWING PROGRAMS USING C/C++/MATLAB

1. To find the roots of non-linear equation using Bisection method.
2. To find the roots of non-linear equation using Newton's method.
3. Curve fitting by least- square approximations.
4. To solve the system of linear equations using Gauss -elimination method.
5. The solve the system of linear equations using Gauss -Seidal iteration method.
6. To solve the system of linear equation using Gauss –jordan method.
7. To integrate numerically using Trapezoidal rules.
8. To integrate numerically using Simpson's rules.
9. To find the largest eigen value of a matrix by Power -method.
10. To find numerical solution of ordinary differential equations by Euler's method.
11. To find numerical solution of ordinary differential equations by Runge -Kutta method.
12. To find numerical solution of ordinary differential equations by Milne's method.
13. To find the numerical solution of Laplace equation.
14. To find numerical solution of wave equation.
15. To find numerical solution of heat equation.

BOOKS SUGGESTED:

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick G. Wheatley - Pearson Education Ltd.
2. Numerical Methods : E. Balagurusamy, T.M.H.

Note: Ten experiments are to be performed out of which at least seven experiments should be performed from above list. Remaining three experiments may either be performed from the above list or designed by the concerned te acher.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
V SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-301	Biomedical Instrumentation-II	3	1	-	3.5
BME-303	Clinical Sciences-I	3	1	-	3.5
BME-305	Medical Imaging Technology-I.	3	1	-	3.5
BME-307-ECE	Communication Engg.	3	1	-	3.5
BME-309-ECE	Fields & Waves	3	1	-	3.5
BME-311	Control System in Medicine	3	1	-	3.5
BME-313	Biomedical Instrumentations –II Lab	-	-	2	1.0
BME-315	Clinical Sciences-I Lab	-	-	2	1.0
BME-317	Medical Imaging Technology Lab	-	-	2	1.0
BME-319-ECE	Communication Engg. Lab	-	-	2	1.0
	Total	18	6	8	25.0

Biomedical Instrumentation -II (BME-301)

Credits-3.5   **L-3 Hours/week**
                                                            T-1 Hours/week

BIOMEDICAL STIMULATORS:

Principles, Varieties and applications, Nerve and muscle stimulators. Pain relievers, Ultrasonic stimulators, diathermy equipment, Electrosurgical Stimulators and analyzers, Functional electrical stimulators.

DIAGNOSTICS AND THERAPEUTIC EQUIPMENTS:

Principles and description of electronic and optical assembly, Principles and description of Endoscopes, Fiber optic endoscopes, Laproscope, Cystoscopes, Principles and description Dialysis equipment-infersoon pumps haemodialysers. Principles and description of Sirometry-Plathysmography, use of body box.

THERAPEUTIC EQUIPMENTS FOR CARDIOLOGY:

Defibriliators-basic principles, comparative stud, energy requirement, synchronous operations, implantable defibrillators. Heart Lung machines basic principles, catheters (Varieties & Use) and oxygenators.

THERAPEUTIC EQUIPMENTS (FOR ICU):

Ventilators-Anesthesia ventilators and critical care ventilators, oxygen and Co_2 analyzers. Pulse monitors, ECG analyzers, pulse meters. Holter monitors, arrhythmia monitors and analyzers.

TEXT BOOKS:
1. Handbook of Biomedical Engineering: R.S.Khandpur
2. Introduction of Analytical Instruments: R.S.Khandpur

REFERENCE BOOKS:
1. Introduction to Biomedical Equipment Technology: Carr-Brown
2. Biomedical Instrumentation: J.G.Webster.

Clinical Sciences-I (BME-303)

Credits-3.5   **L-3 Hours/week**
                                                                   T-1 Hours/week

BASIS OF COMMON DISEASE AND CLINICAL INVESTIGATION:
Diabetes, Hypertension, Rheumatic, heart disease, Ischemic heart disease. Asthma Function of hospital clinical chemistry laboratory, various tests performed. Equipments-automatic clinical analyzer, principle and function:

CARDIOLOGY:
Cardiac cycle, valves and their function- Conducting systems, normal and abnormal ECG's Interpretation of ECG, Cardiac pacing, diagnostic indications, temporary pacing and permanent spacing. Cardiovascular measurements. Heart rate monitor, prosthetic devices, cardiac catherarizatio,heart lung machine, Fibrillation- Atrial and ventricular, cardiac assist devices, principle and application of echo cardiography, trealmill, ergometer, equipments used for open heart surgery.

RESPIRATORY SYSTEM:
Spriometry-Measurement of lung volume plathysmography, FEV, body box, principle and applications. Blood gas analyzer principle and applications, oximeteres.

TEXT BOOKS:
1.   Diseases of kidney: Stranss and Welt.
2.   Clinical nephrology- the kidney diseases: Salomon and Paper.

REFERENCE BOOKS:
1.   Cardiovascular Physiology, Biophysics: Burton
2.   Biomedical Instrumentation: Application and design: J.G.Webster.
3.   Glasser medical Physics.
4.   An Introduction to Biomedical Equipment Technology

Medical Imaging Technology-I (BME-305)

Credits-3.5   **L-3 Hours/week**
                                                            T-1 Hours/week

Basic principles of radio diagnosis, image formation, image analysis. Ultrasoundtransducer, measurement of image system, application ofscan, m mode and b scan, scan scattering and propagation of ultrasound in biological and material with applications to imaging and tissues, sector scan, mechanical sector transducers, linear scan using multi element linear array scanner, annular array system.

Theory and construction of array transducer for imaging, Doppler ultrasound systems and their applications to the study of blood flow. Doppler imaging, practical interpretation of ultrasound

X-ray equipment (soft and hard posts), engineering principles of x-ray system, radiation rotection, scattered radiation and its importance to radio graphical image quality safety specification of x-ray equipment.
Tomographic imaging principle, computerized x-ray tomography.
Magnetic resonance (NMR) (Introduction)
Applied Potential tomography (Introduction)
MRI Machines, functional MRI and spectroscopy.
Medical thermography-thermographics equipment and their application.

TEXT BOOKS:
1.   Handbook of Biomedical Engineering : R.S.Khandpur
2.   Text book of Radiology : Christensens

REFERENCE BOOKS:

1.   Applied Clinical Engineering: Barry N. Femberg
2.   Digital Image Processing: Garzole R.C.

Communication Engineering (BME-307-ECE)

Credits-3.5

L-3 Hours/week
T-1 Hours/week

SIGNALS AND THEIR REPRESENTATIONS:
Fourier Series, Fourier Transform, Continuous spectra, frequency selective networks and transformers.

BASIC FREQUENCY THEORY:
Information, entropy of discrete systems rate of transmission redundancy. Efficiency and channel capacity.

AMPLITUDE MODULATION:
Frequency Spectrum Power Relations, Basic requirements and description of various modulators, comparison, DSB, DSB-SC, SSB, VSB, Spectrum Modulators and Detectors.

FREQUENCY MODULATION:
F.M. frequency spectrum of FM based modulation, Effect of Noise, generation of FM and demodulation.

PULSE MODULATION:
Sampling theorem, low pas and band pass signals, Elements of PAM, PWM, PPM, PCM and Delta Modulation, FDM, TDM

A.M AND F.M. RADIO TRANSMITTERS AND RECEIVERS:
Characteristics, block diagram, superheterodyne receiver.

TEXT BOOKS:
1. Electronics Communication : kennedy
2. Modern Communication Circuits: Roddy and George
3. Principles of Communication System:II; Taub & Schilling

REFERENCE BOOKS:
1. Modern Digital & Analog Communication System: B.P.Lathi
2. Communication System: Symon Haykin

Field & Waves (BME-309-ECE)

Credits-3.5

L-3 Hours/week
T-1 Hours/week

STATIC ELECTRIC FIELDS:

Coulomb's Law, Gauss's Law, potential function, field due to a continuous distribution of charge, equi-potential surfaces, Gauss's Theorem, Poison's equation, Laplace's equation, method of electrical images, capacitance, electro-static energy, boundary conditions, the electro-static uniqueness theorem for field of a charge distribution. Dirac-Delta representation for a point charge and an infinitesimal dipole.

STEADY MAGNETIC FIELDS:

Faraday Induction law, Ampere's Work law in the differential vector form. Ampere's law for a current element, magnetic field due to volume distribution of current and the Dirac-delta function, Ampere's Force Law, magnetic vector potential, vector potential (Alternative derivation), far field of a current distribution, equation of continuity.

TIME VARYING FIELDS:

Equation of continuity for time varying fields, inconsistency of Ampere's Law, Maxwell's field equations and their interpretation, solution for free space conditions, electromagnetic waves in a homogeneous medium, propagation of uniform plane-wave, medium, Maxwell's equations using phasor notation, wave propagation in a conducting medium, conductors, dielectrics, wave propagation in good conductor and good dielectric, depth of penetration, polarization, linear, circular and elliptical.

REFLECTION AND REFRACTION OF E M WAVES:

Reflection and refraction of plane waves at the surface of a perfect conductor & perfect dielectric (both normal incidence as well as oblique incidence). Brewester's angle and total internal reflection, reflection at the surfaces of a conductive medium, surface impedance, transmission-line analogy, pointing theorem, interpretation of E x H power loss in a plane conductor.

WAVE GUIDES:

TE, TM, TEM Modes, rectangular circular, wave guides their properties:
Wavelength, phase velocity, frequency.

TRASMISSION LINE THEORY:

Transmission line as a distributed circuit, transmission line equation, traveling, standing waves, characteristic impedance, input impedance of terminated line, reflection coefficient, VSWR, Smith's chart and its applications.

TEXT BOOKS:
1.   Electro-magnetic Waves and Radiating System : Jordan & Balmain, PHI.

REFRENCE BOOKS:
1.   Engineering Electromagnetics: Hayt; TMH
2.   Electro-Magnetics: Krauss J.DF; Mc Graw Hill
3.   Electro-magnetic field & wave by K.D.Prashad.

Control System in Medicine(BME-311)

Credits-3.5
L-3 Hours/week
T-1 Hours/week

INTRODUCTION OF CONCEPT:
   Open loop systems, closed loop systems, retgulatory servo mechanisms, transfer function and impulse response of system.

STUDY OF COMPONENTS:
   Op-Amp as differential amplifier of error detector, stepper motor, synchronous control transformer, synchronous control, transmitter, potentiometer and two phase servo motor.

MODELING OF SYSTEM:
   RLC circuits, Armature and field controlled motors, importance of mathematical model.

BLOCK DIAGRAMS:
   Various techniques O block diagram reduction, Mason's gain formula and its application to block diagram reduction.

TRANSIENT RESPONSE OF SYSTEM:
   Importance of second order system models, time domain specification of systems and the analysis of transient response using second order model.

STEADY-STATE ERROR ANALYSIS:
   Type of systems, steady state error analysis of different types of systems using step, ramp and parabolic input signals.

STABILITY ANALYSIS:
   Introduction to the concept of stability, stability analysis using Routh-Hurwitz Criterian.

FREQUENCY DOMAIN ANALYSIS OF SYSTEM:
   Frequency domain specification of systems, resonance peak and peak resonating frequency regarding complex poles and zeros, relationship between time and frequency domain specification of systems.

STABILITY ANALYSIS OF SYSTEMS USING BODE PLOTS.
   Biological controls systems, pupil control system, skeletal muscle servomechanism, the semicircular canals free swinging limbs, thermoregulation.

SYSTEM MECHANISM:
   Respiratory models and controls, cardiovascular control systems, visual fixation system, oculomotor system. Sugar level control mechanism endocrine control mechanism.

NEPHROLOGY:

Models of human operator, tracking characteristics biological receptors, transfer function model of receptors. Estimation of constituents of physiological fluids (urinary blood, serum, CSF), Demonstration of a kidney dyalizer.

MEDICAL DEVICES:

Study and operation of various pacemakers, DC Defibrillators, Monitors, Heart Lund Heart Lund machine, hypothermia unit. Blood oxygenate, electrolyte analyzer. Study and operation of spirometers, Measurements of FEV, Lung volume Measurements of conductance and resistance using plathysmography, ICU visit and study the different monitor.

BOOKS:
1. A.H. Patel-A manual of medical laboratory technology
2. Ross and Vilson-Anatomy and physiology in Health and illness.

Biomedical Instrumentation -II Lab (BME-313)

Credits-1.0   **P-2 Hours/week**

To study about operation of various bioinstruments:

1.   Nerve and muscle stimulator
2.   Ultrasonic stimulator
3.   Electrosurgical stimulator
4.   Functional electrical stimulator
5.   Demonstration of various types of Endoscopes, Laparoscope's, Cystoscopes.
6.   Demonstration of Dialysis equipment.
7.   To study/working of Spirometery, Plathysmogram
8.   sit to manufactures workshop.
9.   ECG monitor
10. Defibrillators
11. Holter monitor
12. Ventilators
13. Treadmill, ergometer
14. Demonstration of operation and trouble shooting of:
     Heart lung machine

Visit to Hospital/Medical Institute for Exposure.

Clinical Sciences – Lab (BME-315)

Credits-1.0   P-2 Hours/week

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1.   Visit to a large hospital clinical chemistry laboratory. Operation of autoanalysis, spectrophotometer, Flame photometer.

2.   Study of different equipments
   -   ECG recorder
   -   Patient monitoring systems, ultrasonic fetal monitor, ECG machine, pulse oximeter, respiratory gas analyzer, audiometer cardioscope etc.
   -   Estimation of –constituents of physiological fluids (urinary blood, serum, CSF)

3.   Study and operation of various pacemakers. DC Defibrillators, Monitors. Heart lund machine, hypothermia unit. Blood oxygenator, electrolyte analyzer.

4.   Study and operation of spirometers.
   -   Measurements of FEV, Lung volume
   -   Measurements of conductance and resistance using plathsymography.

5.   ICU visit and study of different monitor

BOOKS:
   1.   A manual of medical laboratory technology: A.H.Patel
   2.   Anatomy and physiology in Health and illness: Ross and Vilson.

Medical Imaging Technology Lab (BME-317)

Credits-1.0   P-2 Hours/week

NOTE: At least perform seven experiments.

1. Study of factors affecting the quality control of X-ray relating the dark room, cassettes & U-films used.

   How the mA (milliamperes) and Kvolts of X ray affect its quality and how it should be monitored.

   How to plan radiology Deptt.- its power supply and dark room.

   Maintenance of X-ray machine (its cooling filament)

   Study of Probes/Transducers – its different frequencies and shapes.

   To study the technique of b-mode and how it is superior to m-mode.

   Demonstration of CT scan-how is CT tube superior to X ray tube.

   Demonstration of MRI.

Visit to Hospital/ Medical Institute.

Communication Engg. Lab (BME-319-ECE)

Credits-1.0   **P-2 Hours/week**

NOTE: At least perform eight experiments are to be performed.

LIST OF EXPERIMENTS:

1. Study of AM Modulation and Demodulation
2. Study of FM Modulation and Demodulation (Reactance modulator, Foster Seely and Ratio Detector Modulator)
3. Study of PAM, PPM, & PWM circuits
4. Study of PCM Transmitters/Receivers
5. Study of DM Transmitters/Receivers
6. Study of TDM Transmitters/Receivers
7. Study of AM Receiver Measurements (Sensitivity, Selectivity, Fidelity)
8. Study of ASK Modulation and Demodulation
9. Study of FSK Modulation and Demodulation
10. Study of ASK Modulation and Demodulation.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
VI SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-302	Medical Devices	3	1	-	3.5
BME-204	Clinical Sciences-II	3	1	-	3.5
BME-306	Microprocessor	3	1	-	3.5
BME-308	Biomaterials & Components	3	1	-	3.5
BME-310	Biomechanics	3	1	-	3.5
BME-312	Rehabilitation Engg	3	1	-	3.5
BME-314	Medical Devices Lab	-	-	2	1.0
BME-318	Clinical Sciences-II Lab	-	-	2	1.0
BME-316	Microprocessor Lab	-	-	2	1.0
BME-320	Biomechanics Lab	-	-	2	1.0
	Total	18	6	8	25.0

PROPOSED NEW COURSE-SCHEME
B. TECH BIOMEDICAL ENGINEERING WITH
IMPLEMENTATION OF CREDIT SYSTEM
(4- YEAR DEGREE COURSE)
W.E.F. SESSION 2006-07

Medical Devices (BME-302)

Credits-3.5   **L-3 Hours/week**
                                                          T-1 Hours/week

THERAPEUTIC EQUIPMENTS (FOR CARDIOLOGY):
        Cardiac Pacemakers, External and Internal Types, Programmable packemakers, leads, wave patten analysis, encapsulation techniques, battering source.

CORONARY CARE DEVICES:
        Coronary Stentsw, Baloon angioplasty, angiography, Laser equipments for plaque remover arrhythmia monitors.

PROSTHETIC DEVICES:
        Artificial limbs, hand & foot, dental prosthesis.

SENSORY DEVICES:
        Intraocular Lens and hearing aids.

BOOKS:

    Albert M Cook/John Webster- Therapeutic Medical Devices.
    Cromwell- Biomedical Instruments and Measurements.
    Service manuals and application rules from manufactures.

Clinical Sciences-II (BME-304)

Credits-3.5   **L-3 Hours/week**
                                                   T-1 Hours/week

FRACTURES:
    Normal healing, material stress and strain at fracture site.

DISLOCATIONS:

    Classification of joints, reduction, replacements muscle power grading, knee and arm.

SUPPORT AND PROSTHESIS:

    Physiotherapy-use and principle, Short Wave diathermy, Nephrology Diganostic applications of radionulides in renal medicine, Principles of dialysis and various type of dialysis, Component if dialyzers, controls and monitoring services of dialyzers.

NEPHROLOGY:
    Diagnostic application of radionuclitdes in renal medicine. Principles of dialysis, haemodialysis and other types of dialysis. Components of dialyzers, controls and monitoring services of dialysers.

BOOKS:

    1.   A text book of Biomedical Engineering: R.M.Kenedi
    2.   Hand book of Bioengineering : R. Shalak and Shu Chein.

Microprocessor (BME-306)

Credits-3.5   **L-3 Hours/week**
                                                   T-1 Hours/week

INTRODUCTION TO MICROPROCESSORs:
    Features, Programmer's Model, External and Internal Organization.

8085 ARCHITECTURE:
    8085 Artchitecture, Instruction Cycles, Machine Cycle States, Address Decoding Techniques, Minimum System Design, Memory Interface timing Consideration, Clock, Reset and Buffering Circuits.

8085 INSTRUCTION SET:
    Instruction Format, Addressing Modes, Classification of Instruction Set .

8085 PROGRAMMING:
    Assembly language programming: Basic structure, data transfer, Arith Logical, Transfer of Control and Miscellaneous Instruction Types.

STACK AND SUBROUTINES
    Stack operations, Limitations, subroutine concepts, parameter passing tech. Subroutines, concept of counters and timers.

I/O DATA TRANSFER TECHNIQUES
    I/O Interface Concepts, Speed consideration, Program Controlled Asynchronous and synchronous I/O techniques, interrupt driven program controlled Direct Memory Access data transfer controlled techniques, Handshake signals, control of serial communication, Matrix keyboard and multiplexed display interface.

INTERRUPTS:
    Requirements, Single Level Interrupt and Vector Interrupt System, 8085 Interrupt Structure and its operation, 8259 A Interrupt Controller.

I/O CONTROLLERS:
    Features, Organization and operating modes of 8155 Multi function device, programmable peripheral interface, 8237 Programming DMA Controller.

INTRODUCTION TO 16 BIT MICROPROCESSOR (8086 as reference)
INSTRUCTION TO 8 BIT/16 BIT MICRO CONTROLLERS(8051 as reference)
Books:
1.   Microprocessor by R S Gaonkar
2.   Microprocessors and Programmable Logic by K. Short.
3.   Microprocessors by P P Tawade & P B Borole
4.   Microprocessors by Gilmore.

Biomaterials & Components (BME-308)

Credits-3.5   **L-3 Hours/week**
T-1 Hours/week

INTRODUCTION OF DIFFERENT TYPES OF BIOMATERIALS:
   A) Polymers
   B) Plastics
   C) Metallic and ceramic biomaterials
   D) Carbon and polymers materials
   E) Adsorbable and porous biomaterials with example
Surface Chemistry of biomaterials, thermal and chemical phenomenon piezoelectric effect.

MECHANICAL PROPERTIES AND TESTS:
   For elasticity, plasticity, anclasticity, disolation deformation and fracture.

POLYMER AND PLASTICS:
   Classification, thermal properties, factors influencing polymer properties.   Polymer compatibility, polymer degradation, resorbable polymers, tissue adhesives, dialysis membrane, sutures.

MATALLIC AND CERAMIC BIOMATERIALS:
   Properties and use to titanium alloys stainless steel, cobalt based alloys degradable ceramics.

CARBON AND POLYMERIC BIOMATERIALS:
   Carbon, polythene, polypropylene, silicones rubber, acryhlic implams, hydrogels.

DENTAL IMPLANTS:
   Alvcolar bone replacements.   Orthopedic implants-types of orthopedic function devices, permanent joint replacements, hipjoints, bone cement, Biological testing of biomaterials.

TEXT BOOKS:
   1.   Biomaterials, An interfacial Approach: Hench L.L. Ethridge E.C.
   2.   Encylopedia of Medical Devices and Instruments. I-IV: John G.Webster, Bols
   3.   Vol.I Biocompatibility of Clinical implantws materials: David F. Williams
   4.   A text book of Biomedical Engineering: Kennedy R.M.

REFERENCE BOOKS:
   1.   Text book of Polymer Sciences: Fred W. Billmeyer Jr.
   2.   The Biomedical Engineering Hand book, CRC Press 1995: Bronzins J.D.
   3.   Biomaterials-An Introduction : J.B. Park
   4.   Biomaterials an Interfacial approach: L.Hench and E.G.Erhridge.

Biomechanics (BME-310)

Credits-3.5   **L-3 Hours/week**
                                                   T-1 Hours/week

INTRODUCTION TO FLUID MECHANISM:
Basic laws governing conservation of mass, momentum and energy, laminar flow, Couette flow and Hager-poiseville equation, turbulent flow.

FLOW DYNAMICAL STUDY OF CIRCULATING SYSTEM:
Heart and blood vessels, Ventricular pr4essure, volume, ECG time based cyclic variation. Determinatin of ventricular wall diastolic, systolic modules vs stress properties and their physiological connotation, Intra-ventricular blood.

FLOW ANALYSIS OF VELOCITY AN PRESSURE GRADIENT:
Arterial impedance relating pulse pressure and flow rate, microcirculatory flow, transcapillary fluid movements in systemic circulation, physiological factors controlling blood pressure, heart valves.

BIOMECHANICAL STRESS STRAIN MODEL:
Muscle in terms of its elastic and contractile elements parameters.

LUNG MACHANISCS;
Lung structure and function, methods of determining lung pressure and volume, airway resistance and conductance.

BOOKS:
1.   Bio Mechanics Circulation : Y.C. Fung
2.   Fundamentals of Biomechanics: Nihat Ozkay & Margareta Nordin

Rehabilitation Engg (BME-304)

Credits-3.5   **L-3 Hours/week**
                                                     T-1 Hours/week

SYSTEMIC APPROACH:
   Review of gross anatomy, composition and mass balances in the human body, the engineering design process, Systems approach, Biomaterials used in artificial limbs, current usage of internal prostheses, bone and joint, ear, nose, throat and vascular prostheses, artificial heart, valves and dialysers.

PROTHESIS AND DEVICES:
   Rehabilitation assistive devices, limb prostheses and orthoses for various handicapped, spinal injury rehabilitation, sensory aids for deaf, blind and mute.

ARTIFICIAL LIMBS:
   Theory of Prosthetic and rehabilitation needs, like artificial limbs. Introduction to simple machines used in orthopaedics departments.

BOOKS:
   1.   Therapeutic Exercise by Sydney Litich
   2.   Massage, Manipulation & Traction by Sydney Litich.
   3.   Rehabilitation techniques by William. E Prentice

Medical Devices Lab (BME-314)

Credits-1.0   **P-2 Hours/week**

1. Demonstration of Pace maker (extent and implantable, power source of implantable pacemaker leads and electrodes)
2. Demonstration of operation and trouble shooting of:
   Heart lung machine.
3. Demonstration of coronary care devices-coronary stents.
4. Study, operation of laser equipments
5. Instrumentation used for open heart surgery-demonstration
6. Visit to orthopedic workshop.

Clinical Sciences-II lab (BME-318)

Credits-1.0   **P-2 Hours/week**

1. Study and operation of Physiotherapy Equipments and Prosthetic Devices.
2. Dithermy equipment (Operation and Demonstration).
3. Orthopedic Appliances
4. Operatio/demonstration of dialysers (Hospital visit).

Visit to Hospitals/Medical Institutes for Exposure.

Microprocessor Lab (BME-316)

Credits-1.0   **P-2 Hours/week**

NOTE:- At least perform eight experiments.

1. Study of 8085 kit
2. At least 10 assembly language program to be run on 8085
3. Interfacing experiments using the following cards.
    a) 8155
    b) 8253
    c) 8257
    d) 8251
    e) 8279
    f) ADC/DAC
    g) Stepper Motor Control
4. Use of Assemblers

Biomechanics lab (BME-320)

Credits-1.0   **P-2 Hours/week**

1. To study the technique of blood flow analysis by Color Doppler.
2. Interpretation of ECG – i.e. diastolic and systolic changes.
3. E.M.G.
4. Spirometry
5. Various physiological parameters posture, exercise etc. their affects on B.P. Pulse & Respiration.

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
VII SEMESTER
Scheme for B. Tech, Biomedical Engineering Programme

Course No	Course Title	L	T	P	Total
BME-401	Biomedical Signal Processing	3	1	-	3.5
BME-403	Medical Imaging & Image Processing	3	1	-	3.5
BME-405	Medical Imaging Tech	3	-	-	3.0
BME-407	Laser & Fiber Optics in Medicine	3	-	-	3.0
BME-	Electives*	3	1	-	3.5
BME-409	Bio-Signal Conditioning	3	1	-	3.5
BME-411	Biomedical Signal Processing Lab	-	-	2	1.0
BME-413	Laser & Fiber Optics Lab	-	-	2	1.0
BME-415	Bio-Signal Conditioning Lab	-	-	2	1.0
BME-417	Minor Project	-	-	4	2.0
	Total	18	4	10	25.0

*= Electives:

1. BME-501   Nanotechnology in Medicine
2. BME-502   Hospital Management
3. BME-503   Nuclear Medicine

Biomedical Signal Processing (BME-401)

Credits-3.5

L-3 Hours/week
T-1 Hours/week

CONCEPTS:
      Signals and Signal Processing: Characterization and Classification of Signals. Typical Signal Processing Operations, Examples of Typical Signals, Typical Signal Processing Applications.

DIGITAL FILTERS:
      Structures: block diagram representation, signal flow graph representation, equivalent structures, basic FIR digital filters, structures, state space structures, all pass filters, tunable iir digital filters, cascaded lattice realization of IIR filters, parallel all pass realization of iir transfer functions, digital sine-cosine generator, computational complexity of digital filter structures. Design: preliminary consideration, impulse invariance method of IIR filter design, bilinear transform method of IIR filter, design of digital IIR notch filters, low pass IIR digital filter design examples, special transformations of IIR filter design on Truncated Fourier Series, FIR Filters, FIR Filter Design Based on Frequency Sampling Approach, Computer-Aided Design of Digital Filters.

DIGITAL SIGNAL PROCESSORS:
      Overview of Motorola DSP 563XXX family of digital signal processor, architectures of DSP56307: assembly language instructions and programming: typical software applications.

IMPLEMENTATION, APPLICATIONS:
      Implementation considerations: basic issues software implementation. Computation of the discrete Fourier transform, the quantization process and errors, analysis of coefficient quantization effects analysis of coefficient quantization effects in fir filters representative applications: dual- tone multi frequency signal detection, analysis using dff short term discrete Fourier transform musical sound processing, digital fm stereo generation, discrete-time analytic signal generation, voice privacy system, sub band coding of speech and audio signals.

NEUROLOGICAL SIGNAL PROCESSING:
      Modeling of EEG signals, detection of alpha, beta, gamma rays Cardiology signal processing-arrhythmia detection algorithms.

TEXT BOOKS:
1.   Digital Signal Processing A Computer-Based Approach Sanjit K Mitra.
2.   DSP Principles, Algorithms, and Applications. John G Proakis & Dimitris G. Manolakis
3.   Understanding Digital Signal Processing: Richard G Lyons.

Medical Imaging & Image Processing (BME-403)

Credits-3.5   **L-3 Hours/week**
                                                   T-1 Hours/week

DIGITAL IMAGING PROCESSING SYSTEM:
Image acquisition storage, processing, communication display. Visual perception: Structure of Human Eye, Image formation in human eye, brightness and contrast, adaptation and discrimination, Block's Law and critical fusion frequency photographic film characteristics.

IMAGE MODEL
Uniform and non-uniform sampling, quantization, Image enhancement: Image smoothing, point operators, contrast manipulation, histogram modification, noise clipping image sharpening, spatial operators, frequency domain method, low pass and high pass filtering, homomorphic filtering, median filtering.

IMAGE TRANSFORMS:
DFT, Properties of 2d Fourier Transforms, Sine and Cosine Transforms, Had amass Transforms. Image Restoration: Degradation Model, A prior knowledge required in restoration, Inverse filtering, Weiner Filtering, Interactive restoration. Image Segmentation: Detection of discontinuity, point line and edge detection and boundary detection, Thresholding, Image interpretation. Biomedical application: Computer Tomography, Emission Tomography, CAT, Radon Transform CAT, MRI Images. Processing of Radiograph, Angiogram, Sonography including Doppler, Projection Theorem, Back Projection.

BOOKS:
1.   Digital Image Processing: R.C.Gonsalez, R.E. Woods,
2.   Fundamental of Image Processing: Anil Kr. Jain.

REFERENCE BOOKS:
1.   Digital Image Processing: William Pratt (John Wiley)

Medical Imaging Tech. (BME-405)

Credits-3.0   **L-3 Hours/week**

MRI:
Principle of MRI/NMR
Concept of K Space & Fourier Transformation
SNR: Signal to Noise Ration and factor effecting SN ration
Sequences on MRI, T1 and T2 Weighted images (contrast), Spin ECHO, Gradient
ECHO and fast imaging techniques.
MR Angiogrphy-Techniques and Principles
Hardware

      a)   Types of Magnets
               Permanent and Electromagnet
               Resistive Magnet & Sureconducting Magnet
      b)   Types of Coils
               Gradient Coils
               RF Coils
               Shim Coils

Digital Data Processing
- Block Diagram of MRI Scanner
- Concept of Digital and analog Domains of MRI

COMPUTED TOMOGRAPHY:

Principles of CT
Generations of Scanners (Evolution)(Data Acquisition Geometries)
X-Ray Detectors Solid State Vs Gas ionization detectors
Data Acquisition System
Image Processing & Reconstruction Principles.

X-Ray
Image intensifier:
Angiography techniques and systems

BOOKS:
1. hand book of Biomedical Engg: by R.S.Khandpur
2. Text book of Radiology: Christensents.

Laser & Fiber Optics in Medicine (BME-407)

Credits-3.0   **L-3 Hours/week**

INTRODUCTION TO LASER:
  Biomedical Laser radiation ranges: infrared radiation, UV radiation, Visible (VIS) radiation.

BIOLOGICAL INTERATION OF LASER;
  Interaction and effects of laser radiations on biological tissues including Scattering, absorption, penetration, temperature rise.
  Biomedical Lasers delivery systems, Optical fibre light guide, beam guiding mirrors and aims.

FIBRE OPTICS:
  Principles and genera description of medical equipments based on it like colonoscopy, Bronchoscope, Ureteroscope.

BOOKS:
  1.   Laser Guide book: Jeffery Hecht
  2.   Laser (2nd edition) :- Bela A. Lengyel

Nanotechnology in Medicine (BME -501)

Credit 3.5
L-3 Hours/week
T – 1 Hours/Week

NOTE: Five out of eight questions are to be attempted.
NANAOMATERIALS: Nano materials science for interfacing with living tissue; Design of smart micro particles and Nanoparticles for advanced medicine.

HIGH DENSITY BIOMEDICAL NANOSENSORS:

Real-Time sub cellular imaging of nanostructure; Nanotechnologies to detect biological signals and single molecules within and outside cells. Fundamentals principles and tools to measure and image the biological processes of health and diseases; and methods to assemble nanosystems. Time-of-flight mass Spectrometry of Biological molecules using Atom -probe Microcopies. Implantable nonscale electronic processors integrating with biological pathways and modifying biological processes. Lab -on-a-chip diagnostics techniques.

STEM CELL BIOENGINEERING:

Nanotechnology, Growing a neural Network in culture and using it to design treatments. Technologies basis of study of gene expression by single cell RNA.

Hospital Management (BME -502)

Credit 3.5   L-3 Hours/week
                                                                 T – 1 Hours/Week

        Introduction to hospital as a management system: Hospital in the total healthcare system, Outline for healthcare delivery system, international, national. WHO, UNICEF, out patient and inpatient departure s: investigation departments: emergency service: dem ands for various services; materials and personnel requirements: types of clinics in urban and rural settings. Different types of services, Preventive, diagnostic and management, their interrelationship.

        Introduction to healthcare effectiveness measures and problems scheduling and inventory in hospital management. Examples of applications of constrained optimization; stochastic queuing model of effectiveness in medical systems.

BOOKS:

1.   Analysis of public Drake A.W. Keerveu R.L. and Morse P.M.
2.   Qualitative methods for Public Decision Making. Mekenna C.K.
3.   Operations Management in the Health Services; Planning Restructuring and Control: Nelson C.W.

Hospital Organisation and Management , S.P. Medical and Science Book Publication: Rakich J.S. Darr K.

Bio-Signal Conditioning (BME-409)

Credits-3.5   **L-3 Hours/week**
                                                      T-1 Hours/week

Origin of Biopotentials

Electrical Activity of Excitable Cells, Volume Conductor Fields, Functional Organization of the Peripheral Nervous System, The Electroneurogram (ENG), The Electromyogram (EMG), The Electrocardiogram (ECG), The Electroretinogram (ERG), The Electroencephalogram (EEG), The Magnetoencephalogram (MEG).

Biopotential Electrodes.

The Electrode Theory, The Electrode-Electrolyte Interface, Polarization, Polarizable and Nonpolarizable Electrodes, Electrode Behavior and Circuit Models, The Electrode-Skin Interface and Motion Artifact, Body-Surface Recording Electrodes, Internal Electrodes, Electrode Arrays, Microelectrodes, Electrodes for Electric Stimulation of Tissue, Practical Hints in Using Electrodes.

Bio-Signal Processing

Ideal Op Amps, Inverting Amplifiers, Noninverting amplifiers, Differential Amplifiers, Comparators, Rectifiers, Logarithmic Amplifiers, Integrators, Differentiators, Active Filters, Frequency Response, Offset Voltage, Bias Current, Input and Output Resistance, Phase-Sensitive Demodulators, Microcomputers in Medical Instrumentation

References:
1   John G. Webster, "Medical Instrumentation" third edition, published by John Wiley & Sons (Asia) Pte Ltd.,2 Clementi Loop, Singapore.

2   B H Brown, R H Smallwood, D C Barber, P V Law ford, D R Hose, " Medical Physics and Biomedical Engineering" published by Overseas Press India Pvt. Ltd. 7/28, Mahavir Street, Ansari Road, Daryaganj, New Delhi-110 002.

Biomedical Signal Processing Lab (BME-411)

Credits-1.0   **P-2 Hours/week**

The microcomputer based medical instrument

Analog filters, ECG amplified and QRS detection

Signal conversion circuits

Elements of a digital filters and transfer function of different equation

Fir filter design

IIR digital filter for ECG analysis (Infinite Impulse Response)

Integer filters for ECG analysis

ECG signal averaging

ECG data reduction algorithm

Frequency domain analysis of the ECG

Real time ECG processing algorithm

Finite length registers effects in digital filters.

Laser & Fiber Optics lab (BME-413)

Credits-1.0   **P-2 Hours/week**

1. Introduction to fiber optic medical instruments: Endoscope, Colonoscope, Bronchoscope, uteroscope

2. Demonstration and use of Laser in medicine ex. Cataract and Eye Surgery

3. Demonstration of Diff. Types Lasers.

4. Demonstration of Biomedical Laser delivery system

Bio-Signal Conditioning Lab (BME-415)

Credits-1.0   **P-2 Hours/week**

Note: At least 8 experiments have to be performed.

1. Study of EEG Signal & Signal Generation Process

2. Study of the EMG Signal. Measurement of Amplitude, Frequency & Nature of ENG.

3. Using ENG simulator and EMG Amplifier check the body signal & simulator signal.

4. To study Electroencephalograph Trainer in Unipolar recording mode.

5. To study Electroencephalograph Trainer in Average recording mode.

6. To study the EMG waveforms of Human Body & study of EMG waveform generated by built-in EMG simulator

7. Design of Inverting & Noninverting Amplifiers using OP Amp.

8. Design of the circuits of linear applications of OP Amp like Adder, sub tractor, multiplier, integrator, differentiator, etc.

9. Design of the circuits of non linear applications of OP Amp like Comparator, Peak detector, Precision rectifier, etc.