III to VI Semester B.E.
(Biomedical Engineering)

Prospectus No. **111733**

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SANT GADGE BABA AMRAVATI UNIVERSITY

(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

PRESCRIBED FOR

FOUR YEAR DEGREE COURSE

BACHELOR OF ENGINEERING

BIOMEDICAL ENGINEERING

III to VI SEMESTER

EXAMINATIONS, 2010-2011

SEMESTER PATTERN

2010

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SYLLABUS
PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
B.E. BIOMEDICAL ENGINEERING
III[rd] & IV[th] SEMESTER EXAMINATIONS
SEMESTER PATTERN
THIRD SEMESTER

Inpalnt Training & Industrial Visit in the faculty of Engineering & Technology

1)
a) the inplant training shall not be compulsory,
b) the inplant training shall be taken by students strickly during Summer vacation. after IVth or VIth Semester examination and / or during Winter vacation after Vth or VIIth Semester examinations,
c) the inplant training shall not be part of examination system, however, student shall prepare and submit report after completion of training to the concerned Head of Department alongwith certificate issued by the industry,
d) the inplant training shall be of minimum two weeks duration,
e) there shall not be any liability whatsoever on the Institution with respect to implant training of the students,
f) students shall undertake inplant training on their own risk and cost. An undertaking in this regards signed by student and parents shall be submitted before proceding for training to the concerned Head of Department/ Head of Institution.
g) the students shall complete inplant training under the supervision of concerned person in the industry,
h) Institutes shall help students to organise inplant training by way of correspondance,

2) Industrial Visit : Industrial visit may be organised for the students. Students should prepare & submit the report on Industrial visit to the concerned Head of Department/Head of Institution.

3SB1 **TRANSFORMS & PROBABILITY**

Unit I: Fourier Series: Introduction: Euler's formula; Problems on general Fourier Series; Conditions for Fourier Expansion; Fourier Expansions of Discontinuous Functions; Even and Odd functions; Change of interval; Half range series; Typical Waveforms (Square, Sawtoothed, Triangular, Half Wave rectifier, Full Wave rectifier); Parseval's Identity

Unit II Fourier Transform (FT) and its properties; Inverse Fourier Transform; Fourier transform of derivative; Convolution; Application of Fourier Transform in solving partial differential equations - Laplace's Equation (2D only), Heat Conduction Equation (I D only) and Wave Equation (I D only).

Unit III Calculus of Complex Variable: Functions; Limits and Continuity; Analytic Functions; Cauchy Riemann Conditions; Analytic Continuation; Complex Integration and Cauchy's Theorem; Cauchy's Integral Formula; Taylor's and Laurent Series; Zeros of an Analytic Function; Poles; Essential Singularities; Residue Theorem (statement only) and it's application to evaluation of integral; Introduction to Conformal Mapping; Simple problems.

Unit IV Probability and Statistics:
Mean, Median, Mode and Standard Deviation; Samples Space; Definition of Probability; Conditional Probability; . General Multiplication Theorem; Independent Events; Bayes' Theorem; Random Variable; Discrete and Continuous Probability

Unit V Distributions - Probability mass function; Probability density function; Distribution Function; Expectation; Variance; Probability Distribution-Binomial, Poisson and Normal. Correlation and Regression; Method of Least Squares; Linear Curve Fitting.

Unit VI Graph Theory:
Graphs; Digraphs; Isomorphism; Walk; Path; Circuit; Shortest Path, Tree; Properties of Tree; Binary Tree; Fundamental Circuit; Minimal Spanning Tree: Kruskal's Algorithm; Prim's Algorithm. Cut Set; Fundamental Cut Set and Cut Vertices; Matrix Representation of Graphs . Network; Flow Augmenting Path; Ford-Fulkerson Algorithm for Maximum Flow; Max Flow - Min Cut Theorem

Text Books:

I. Grewal B S: Higher Engineering Mathematics (thirtyfifth edn) - Khanna Pub.
2. Lakshminarayan- Engineering Math 1.2.3
3. Prasad: Partial Differential Equations, New Age International
4. Spiegel M R: Theory and Problems of Complex Variables (Schaum's Outline Series) - McGraw Hill
5. Ross S L: Differential Equations - John Willey & Sons.
6. Bhat: Modern Probability Theory, New Age International
7. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.

3SB2 **HUMAN PHYSIOLOGY**

Unit I Basic Biological (Biophysical & Biochemical) Principles:

Diffusion, surface tension and viscosity - their characteristics, factors influencing and biological applications. Osmosis - osmometers,laws of osmosis, biological applications, relation with depression of freezing points. Acids, bases and pH. Colloids - classification,properties - optical and electrokinetic, biological importance of colloids. Dialysis and ultra-filtration. Electrophoresis: Principles & applications, Gel electrophoresis. Adsorption. Gibbs-Donnan equilibrium. Radioactivity - radioisotopes and their biological applications. Principles of radioimmunoassay (RIA), autoradiography. The resting membrane potential. The action potential. Electrotonic potentials. Propagation of nerve impulse in different types of nerve fibers. Compound action potentials.

UnitIl Genetics:

Nucleic acid- I. Structure of DNA- Physical & Chemical properties of DNA & RNA, Ultra structure & types of DNA & RNA(indetails), Brief idea about super coiling of DNA Semiconservative mode of replication of DNA, Mechanism of replication of DNA"Genetic code. Genetically relation of color blindness and ocular albinism.Chromosome

aberration- Structural aberration- Deletion- Duplication- Inversion- translocation. Numerical aberration (Polyploidy - &aneuploidy- Hyper & hypo). Gene mutation- classification- spontaneous & Induced- Chemical mutation- Practical Application of mutation.

Unit III Blood Vascular system

Composition and functions of blood. Plasma proteins - normal values, origin and functions. Brief idea on Bone marrow. Formed elements of blood - origin, formation, functions and fate. Hemoglobin - functions, compounds and derivatives. Abnormalhemoglobin-overview. Thalassemia-brief idea. Different types of anemia and their causes-overview. Erythrocyte sedimentation rate(ESR) and its significance. Hematocrit. PCV, MCV, MCH~ MCHC. Blood volume -normal values, regulation. Blood coagulation -factors, process, anticoagulants, Prothrombin time. Clotting time. Bleeding time. Blood groups - ABO systems and Rh factors. Bloodtransfusion.UItra structure & functions of blood vessels (artery & vein). Structure type and function of capillaries. Differences between artery &vein.

Unit IV Muscular Physiology:

Microscopic and electron microscopic structure of skeletal, smooth and cardiac muscles. Difference between skeletal, smooth andcardiac muscles. The sarcotubular system. Red and white striated muscle fibers. Single unit and multi unit smooth muscle. Motorpoint. Properties of muscle: excitability and contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity. Electromyography. Muscle contraction - E C Coupling, Muscle fatigue, Rigor mortis, Sliding filament theory, Slow & fast musclefibers, Isotonic & Isometric contraction.

Unit V Neuro Physiology:

Electron microscopic structure of nerve cell or neurons. Neuroglia. Myelinated and unmyelinated nerve fibers. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibers. Synapses - types, structure, synaptic transmission of the impulse, synaptic potentials, neurotransmitters. Motor unit. Injury to peripheral nerves- degeneration and regeneration-brief idea. Automatic nervous system - Introduction, Comparison of autonomic & somatic nervous system, Anatomy of autonomic motor pathways - Pre-ganglionic neurons, autonomic ganglia, sympathetic ganglia, autonomic plexus, post-ganglionic neurons structure of sympathetic and parasympathetic division. ANS- neurotransmitter and receptors- cholinergic neurons & receptors. Receptor agonist & antagonist. Physiological effect of ANS- sympathetic & parasympathetic response. Integration & control of autonomic function- autonomic Reflexes, autonomic control by higher centers.Neural Transmission- Introduction, Autonomic Synaptic Transmission-Modes of transmission, sympathetic & parasympathetic response. CNS Synaptic transmission- Electrical synaptic transmission & chemical synaptic transmission.Neuro muscular Junction - The neuromuscular junctions - structure, events in transmission, end-plate potential, post titanic potential.

Unit VI Cardio Vascular System

Structure & function of Heart & blood vessels (m1ery, vein and capillary) (Anatomical position, chambers of heart.) Blood circulationthrough heart. Special Cardiac cycle. Heart Sound , Blood vessels - type, Structure & function, Systemic & pulmonary circulation. Blood - composition, Function,

blood group, Blood clotting. Cardiac cycle and cardiac output. Blood Pressure-regulation & controlling factors.

. Renal System- Function of kidney, Anatomy & Histology of Nephron & collecting duet. - Urine formation (Filtration, reabsorbtion and secretion)- Counter - current system of urine concentration, Anomalies in urine concentration. Physiology Practical Code: BME 392

Text books

1. Snell, Bio Physical Principles of Structure and functions
2. Ruch and Patton, Bio Physics and Medical Physiology

Reference books

1. Concise medical physiology by Sujit K. Chaudari , New central book Agenc Pvt. Ltd.
2. Textbook of Physiology by Chattergi

3SB3 / 3SI4 TRANSDUCER AND SIGNAL CONDITIONING

SECTION A

UNIT I: Transducer : Defination, Classification, Selection criteria.Errors Loading effects, Basic configuration of control system Transducer specifications. (07)

UNIT II: Displacement,Fore & Torque Transducers: Displacement Resistive, Inductive, Strain gauge, Capacitive, Piezo electric Digital, fibre optic, Laser type transducers.

Force-Force measuring transducers, Electric load cell,LVDT, Piezo electric type.

Torque Strain Gauge transducers. (08)

UNIT III: Temperature Transducers: Temperature scales,Glass thermometers,Bimettalic & memory shaped alloy thermometers, Semiconductor, temprature detector (thermistor & P-N junction). Resistance themometer, Themocouples,Ultrasonic, Crystal, Infrared thermometers

Velocity Transducers: Tachometers, Toothed rotor tachometers,photo electric, Stroboscopic principles. (09)

SECTION-B

UNIT IV : Flow Transducers: Basic measurement principles, Bernoulli's theorem, Differential pressure type (Orifice, Ventury,Anubar Pitot tube),Variable area type, Magnetic, Ultrasonic,Positive displacement type ,Mass flow meter, Annemometer,Total flow meter.

Level Transducers:For liquids & solids - float type displacer, Diaphragm box level gauge ,DP cell Ultrasonic, Radioactive transducers,Microwave. (10)

UNIT V: Pressure Transducers: Pressure scales & standards, Manometers, Elastic(Bellows,Bourdon tube,Diaphragm)type, Electrical pressure sensors (LVDT,Strain gauge,load cell,Piezo-electric,Capacitive),Differential pressure sensors(Capacitive,Force balance & vibrating cylinder type),vacuum pressure measurement, thermal conductivity & ionization type, Transducers for very high pressure measurement. (09)

UNIT VI: Humidity Transducers:Psycrometer,Hygrometer(Hair,wire & Electolysis type),Dew point meter.Piezo-electric humidity meter,Infrared conductance & Capacitive type probes for moisture measurement.Acoustic Transducer & sound level measurement. pH & Conductivity sensors:pH scales & standards,principle of pH measurement,Different types of reference & measuring electrodes.Principles of conductivity measurement, conductivity cells & bridges. (09)

LIST OF EXPERIMENTS

1. Testing & calibration of T,J,K,R & S thermocouples
2. Callibration of pt-100.
3. a) Callibration of strain indicator
   b) Weight measurement by load cell.
4. Study of LVDT & irrs application in thickness measurement
5. Level measurement by capacitance probe.
6. Flow measurement by Differential pressure type transducers
7. Study of Bellows,Bourdon tubes & Diaphragms.
8. RPM measurements using photodetector technique.
9. Study of electrical pressure probes.
10. Study of pH meter,conductivity meter.
11. Humidity measurement by psycrometer.

Note : Students are expected to perform minimum eight experiments

REFERENCE BOOKS :

1. Measurement System by E.O.Doebelin
2. Principles of Industrial Instrumentation by Patranbis
3. Experimental Methods for Engineers by J.P.Holman
4. Mechanical Industrial Measurements by R.K.Jain

3 SRNB 4 ELECTRONIC DEVICES & CIRCUITS

SECTION-A

UNIT I: Diodes : Characteristics of semiconductor diodes,diode resistanse. Rectifying circuits & do power supplies,HWR,FWR,BR,comparison. Filter circuits for power supplies: Inductor, Capacitor, LC, IT Filters.

UNIT II : Concept of amplification,Ai,Av and Ap; Ri,Ro.Conversion efficiency. Basic transistor operation,Basic characteristics of transistor amplifier. Transistor input characteristics,CB amplifier CC amplifier.

UNIT III: The CE amplifier Graphical analysis, Input & output resistance, Input wave form consideration, Comparison of amplifiers. Transistor biasing : Stability Factor, CB bias , Emitter bias, Bias compensation.

SECTION-B

UNIT IV : Oscillatars : Effect of positive feedback. phase-shift oscillator, Wein-Bridge oscillator, RC Oscillator, Transistor as a switch, switching time in transistors, Multivibrators.

UNIT V : FET amplifiers: Advantages & disadvantages of FET. Principle of operation, characteristics, Comman source AC amplifier. Fixed Bias. Source follower, Frequency Response. Introduction is MOSFETS.

UNIT VI: Opto Electronic Devices : Fundamentals of light, photoconductive sensors, photodiodes, phototransistors, their principle of operation & applications.photovoltaic sensors.photoemiss ive sensors.Light emitters,Alphanumeric displays. photocouplers.

Text Books :

1. Malvino : Principles of Electronics (TMH)
2. Millmam & Halkias : Electronic Devices & Circuits (Mc Graw Hill)
3. Millmam & Halkias: Integrated Electronics (Mc Graw Hill)
4. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).

3SB5 BIOPHYSICS

Unit I :- Body fluid: Properties of body fluid, determination of conduction of body fluid, measurement of EMF of cells, temperature and reaction rates: Arrhenius equation. Photochemical reaction, the law of photochemistry, fluorescence and phosphorescence, Principles of colorimeter, Beer-Lambert's law.

Unit II :- Biophysical activity of heart: electrical activity of the heart, junctional tissue of heart.(Myogenic and neurogenic heart-conducting system of heart). monophonic and biphasic recordings, original and propagation of excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiography, waveform and easurement, ECG in diagnosis, arrhythmia's, flutter, fibrillation, vulnerable period, phonocardiography, ballistocardiography.

Unit III :- Biophysical activity of brain and other organs: electrical activity of brain, waveforms & measurements, electrogastrography, electroneurography, nerve conduction studies, electroretinography, electroocculography, recording electrodes, interfaces,skin contact impedance, biological transducers, receptor potentials.

Unit IV :- Introduction to electrical simulation: Properties of nerve fibers - excitability, conductivity, all-ornonelaw, accommodation, adaptation, summation, refractory period, indefatiguability impedance & current distribution, dielectric properties of biological materials, skin impedance, total body impedance, impedances at high frequencies, high voltage & transient properties, patient safety, electrical shocks and hazards, leakage currents, types & measurements, protection against shock, burn & explosion hazards.

Unit V :- Radioactivity: Radio emission, radioisotopes, law of radioactive decay, half life period, production of radio isotopes for medical use, electromagnetic radiation, interaction of radiation with matter, exponential attenuation, half value thickness, photo electric, Compton and pair production process and their significance in radiology, radiation units, detection and measurements of radiation

Unit VI :- Introduction of ultrasonic wave: Ultrasonic wave motion, wave characteristics, intensity, and ultrasound properties in body (velocity, attenuation, reflection, refraction and absorption). Use of ultrasound in biological field.lntroduction of magnetic field: Optical activity and magnetic rotation of substances, dipole moments, magnetic properties of substances. Useful and harmful effects of magnetic fields, radio waves, micro waves, ultra violet radiation and infrared radiation on human beings.

Text books

1. W.R.Hendee & E.R.Ritenour, Medical Physics.
2. Massey and Meredeth, Medical Physics.

Reference books

1. Plummer, Bio Chemistry - The Chemistry of Life, Mc Graw Hill.
2. Patrick Rcully, Electrical Simulation & Electropathology, Cambridge University press
3. Joseph Bronzino, Biomedical Instrumentation.
4. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill
5. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book.

FOURTH SEMESTER

4SB1/3SR5 OBJECT ORIENTED TECHNOLOGIES

SECTION-A

UNIT I. Objects & Classes in C++ : Declaring & using classes, Constructors, Objects as functions arguments, Copy Constructor, Static class data. Arrays of objects, C++ String class.

UNIT II. Operator overloading : Overloading unary & binary operators. Data conversion. Pitfalls of operator overloading. Pointers & arrays. Pointers & functions. new & delete operators. Pointers for objects.

UNIT III. Inheritance in C++ : Derived class & base class, Derived class constructors, Function overloading, class hierarchies, Public and private inheritance, Multiple inheritance. Containership : classes within classes.

SECTION-B

UNIT IV. Virtual functions concepts, Abstracts classes & pure virtual functions. Virtual base classes, Friend functions, Static functions, Assignment and copy initialization, the this pointer. Dynamic type information.

UNIT V. Streams & Files in C++ : Stream classes, stream errors, disk file I/O with streams, File pointers, Error handling in file I/O. File I/O with members functions, overloading the extractions & insertion operators, Memory as a stream object, command-line arguments. Multifile programs.

UNIT VI. Function Template, Class templates, Exception syntax, Multiple exceptions, exception with arguments. Introduction to the Standard Template Library. Algorithms, Sequential Containers, Iterates, Specialized iterates, Associative containers. Function objects.

Text-Book :

1. Robert Lafore Object-Oriented Programming in C++ (Galgotia)
2. Herbert Schildt C++ : Complete Reference (TMH)

References :

1. Bjarne Stroustrupe C++ Programming Language (Addison-Wesley)
2. Venugopal Mastering C++ (TMH)
3. Lipmann C++ Primer (Addison-Wesley)

LIST OF PROGRAMS

The sample list of program is given below. This list can be used as guide line for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1 Write a C++ program to implement a stack with its constructor and two member functions PUSH and POP
2 Write a C++ program to find product of two same numbers from 0 to 9 stored in an object array of 10 objects and then free the memory space occupied by an object array
3 Write a C++ program to overload minus operator as an unary and binary operator
4 Write a C++ program using friend operator function to overload plus binary operator
5 Write a C++ program to calculate the circumference of an earth (subclass) after getting distance of it measured from sun from planet (super class)
6 Write a C++ program for an inventory that stores the name of an item, the number on hand, and its cost. Include an inserter and an extractor for this class
7 Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file
8 Write a C++ program that counts number of words in a file
9 Write a C++ program to create an abstract class area having an abstract function get Area which will find an area of derived classes rectangle and triangle
10 Write a C++ program to create a generic function that swaps the values of the two variables it is called with"

4 SB 2/4SR3 ANALOG AND DIGITAL ICS

SECTION-'A' (8 hrs/unit)

UNIT-I : Introduction to ICs: Monolithic IC technology,the planner process, fabrication, BJT, FETs, CMOs Technology, characteristic of IC components, LST, Operational amplifier, Block schematic internal circuits, Level shifting,Overload protection,study of IC 741 op-amp,Measurement of op-amp parameter.

UNIT-II: Liner and Non-Linear Application Op-amp:-Inverting and noninverting amplifiers, Voltage follower, integrator, differentiator differential amplifier, Sinusoidal RC-phase shift and Wein bridge oscillators, clipping, clamping and comparator circuits using opamps. Astable, bistable and monostable multivibrator using opamps.

UNIT-III: Other linear ICs:- Block schematic of regulator IC 723, and applications, SMPS, Block schematic of timer IC 555 and application as a timer, astable, monostable, bistable multivibrator and other applications.

SECTION-'B'

UNIT-IV: Basic Logic Circuits:

Logic gate charcteristics,NMOS invertor, propogation delay,NMOS logic gate,CMOS invertor,CMOS logic gates, BJT invertor, TTL NAND gate, TTL output stage. TTL logic families, ECL circuits,comparision of logic families.

UNIT-V: Combinational Digital Circuits: Standard gate assemblies, Binary address, Arithmetic functions, Digital comparator, Parity check generators, Decode-multiplexer, Data selector multiplexer, Encoder, ROM, 2-dimensional addressing of ROM, ROM applications, PROM.

UNIT-VI: Sequential Circuits and Systems:Bistable Latch, Flip-Flops clocked SR, J-K, T, D type shift Registers, F.F.Design of counters, Ripple and synchronous types, application of counters, Dynamic MOS shift registers,RAM Bipolar RAM cells.

BOOKS :

1. Millaman : Microelectronic : 2nd Ed.Mc Graw Hill.
2. David A Bell "Electronic Devices & Circuits" (5/e) (Oxford University Press).
3. Gayakwad : Op-Amp & Linear IC's, 2nd Ed.
4. Malvino & Leach : Digital Principles & Applications, 4th Ed. Mc Graw Hill.

Analog & Digital ICs Laboratory

List of Expermients:

1. INV-NON INV Amplifer using IC 741.
2. INTEGRATOR & DIFFERTIATOR using IC 741.
3. Voltage follower using IC 741.
4. Weinbridge oscillator using IC 741.
5. Astable Multivibrator using IC 741.
6. Astable Multivibrator using IC 555.
7. Voltage regulator using IC 723
8. Verification of MUX using IC 74151.
9. Study of various DEMUX chips & verification of DEMUX using IC 74155.
10. Verification of transistor inverter.
11. Verification of BCD to seven segment using IC 7447.
12. Verification of J-K FF by using IC 7476.

13. Verification of Comparator using IC 7485.
14. Verification of BCD to demical decoder using IC 7442.
15. Verification of decade counter.
16. Code converters using PLAs.

NOTE : Any six from Sr.No. 1 to 7 and six from Sr.No. 8 to 16.

4SULEIB3 NETWORK ANALYSIS

SECTION-'A'

Unit-I : Basic Circuit elements: Circuit components- assumptions for Circuit analysis, sources of electrical energy-standard input signals- Kirchoff's laws-source transformation- mesh and node analysis-network equation for RLC network-magnetic coupling. (10)

Unit-II : Graph theory and network equation:- Graph of a network-Tress and loops, cut set of a network, Tie-set matrix and loop currents- analysis of network, Network equilibrium equation,dualit-network trasformation. (10)

Unit-III: Laplace transformation and its applications:- Laplace transfor mations-basic theorems-gate function-Impulse function-Laplace transform of periodic functions.

Solution of linear differential equations-Heaviside's partial fraction expansion-Solution of network problems. (10)

SECTION-'B'

Unit-IV: Network theorems:- Superposition theorem-Reciprocity theorem, Thevenin's theorem-Norton's theorem-Milliaman's theorem-Max. power transfer theorem-Substitution theorem-Compensation theorem, Tellegen's theorems. (10)

Unit V : Twoport network:- Open circuit impedance parameters-short circuit admittance parameters-Transmission parameters-Inverse transmission parameters-Hybrid and inverse hybrid parameters. interrelationship between the parameters-two port symmetry interconnection of two port networks, input impedance in terms of two-port parameters output impedance-image impedance. (10)

Unit-VI: Network functions:- Ports and terminal pairs-network functions-poles and zeros-necessary conditions for driving point function-necessary conditions for transfer function-Applications of network analysis in driving network functions-positive real functions-driving point and transfer impedance funcion-LC net work (10)

TEXT BOOK :

Network and systems-D,Roy Choudhary (Wiley Eastern Ltd.1988)

REFERENCES-

1. Circuit Theory-ISKV Iyer (Tata Mcgraw Hill)
2. Network Analysis, M.E.Van Valkenburg (Prentice Hall India) 3rd Ed.

PRACTICALS-

About 10 experiments based on above syllabus.

4SRULEINB4 SOCIAL SCIENCES & ENGINEERING ECONOMICS

SECTION - A (8 hrs/unit)

Unit I : Study of Social Science : Importance to Engineer, salient features of Indian constitution. Fundamental Rights and Duties. Directive Principles of State Policy.

Unit II : Indian Parliament : composition and powers.
President of India : Election and Powers.
Council of Ministers and Prime Minister

Unit III: Impact of Science and Technology on culture and Civilization. Human Society : Community Groups, Social Control : Meaning, Types and Agencies. Marriage and Family : Functions, Types and problems.

SECTION - B

Unit IV: Nature and scope of Economics : Special significance of Economics to Engineers.
Production : Factors of production, Laws of return, Various Economic systems, Forms of Business Organisation.

Unit V : Banking : Functions of Central and Commercial Banks.
Taxation : Principle of taxation, Direct and Indirect taxes.
Market : Forms, perfect and imperfect competition, pricing under perfect and imperfect competition, prices discrimination under monopoly.

Unit VI: Economics of Development : Meaning, Characterisitcs of under development, obstacles to Economic growth and vicious circle of poverty.
Economic Planning : meaning, objective and salient features of current five years plan of India.
Planning horizons, life structuring the alternatives.
Economics of comparision of different alternative projects.

Books Recommended :

1. Pylee M.V. : Constitutional Govt. in India, S.Chand and Co.
2. Joshi G.N. : The Constitution of India, Macmillan India Ltd.
3. Mahajan : The Constitution of India, S.Chand, New Delhi.

4. Maclaver and Page : Principle of Sociology.
5. Davis K. : Human Society
6. Dewett and Varma J.D. : Elementary Economic Theory, S.Chand and Co.
7. A.N.Agrawal : Indian Economy, Problem of Development and Planning (Wiley Eastern Ltd), New Delhi.
8. S.K.Mishra : Indian Economy, Its Development Experience. Himalaya Pub.House, Bombay.
9. Datt R.K. : Indian Economy, S.Chand and Comp. New Delhi P.M.Sundharam
10. Dhingra I.C. : Indian Economy
11. E.Kuper : Economics of W.R.Development, McGraw Hill Co.,
12. Jemes L.E., R.R.Lee : Economics of W.R.Planning, McGraw Hill Co.

4SB5 BIOMATERIALS & BIOMECHANICS

Unit I :- Introduction: Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials.Metallic implant materials: Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Host tissue reaction with biometal, corrosion behavior and the importance of passive films for tissue adhesion. Hard tissue replacement implant: Orthopedic implants, Dental implants.

Unit II :-: Introduction of polymers, Polymeric implant materials, Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. Physiochemical characteristics of biopolymers. Biodegradable polymers for medical purposes, Synthetic polymeric membranes and their biological applications.Ceramic implant materials: Definition ofbioceramics. Common types ofbioceramics: Aluminium oxides, Glass ceramics,

Composite implant materials: Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out).

Unit III :- Biocompatibility & toxicological screening of biomaterials: Definition of biocompatibility, blood compatibility and tissue Compatibility. Toxicity tests: acute and chronic toxicity studies, sensitization, carcinogenicity, mutagenicity and special tests.Sterilisation techniques: ETO, gamma radiation, autoclaving. Effects of sterilization on material properties. Testing of biomaterials/lmplants: In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals):

biological performance of implants. Ex-vivo testing: in vitro testing simulating the in vivo conditions.

Unit IV :- Hard tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models - anisotropy, Electrical properties of bone, fracture mechanism and crack propagation in bones, fracture fixators, repairing of bones, mechanical properties of collagen rich tissues, teeth and its properties.

Unit V :- Soft tissues: Structure and functions of cartilages, tendons, ligaments, soft tissue mechanics, mechanical testing of soft tissues standard sample preparation, cross-section measurement, clamping of the specimen, strain measurement, environmental control, time dependent properties of testing. Biomechanics of joints: Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee, mechanics of ankle.

Unit VI :- Locomotion: Human locomotion, gait analysis and goniometry, Ergonomics, F:oot Pressure measurements - Pedobarograph, Force platform, mechanics of foot. Total Hip Prosthesis: requirements, different types of components, Stress analysis & instrumentation, Knee Prosthesis.Cardiovascular mechanics: Heart valves, artificial heart valves, biological and mechanical valves development.Fluid mechanics: introduction, viscosity and capillary viscometer, laminar flow, turbulent flow.

Test books

1. J B Park, Biomaterials - Science and Engineering, Plenum Press,
2. Sujata V. Bhat, Biomaterials, Narosa Publishing House,
3. Alexander R Mc Neill, Biomechanics, Chapman and Hall,

Reference books

1. Jonathan Black, Biological Performance of materials, Marcel Decker,
2. Piskin and A S Hoffmann, Polymeric Biomaterials (Eds), Martinus Nijhoff Publishers.
3. Eugene D. Goldbera, Biomedical Ploymers, Akio Nakajima.
4. Lawrence Stark & GyanAgarwal , Biomaterials
5. L. Hench & E. C. Ethridge, Biomaterials - An Interfacial approach.
6. A Z Tohen and C T Thomas, Manual of Mechanical Orthopaedics
7. D N Ghista and Roaf, Orthopaedic Mechanics, Academic Press
8. VC Mow and W C Hayes, Basic Orthopedic Biomechanics, Lippincott, Raven publishers.

****

ENVIRONMENTAL STUDIES

Total Marks : 100

PART-A

SHORT ANSWER PATTERN **25 Marks**

1. **The Multidisciplinary nature of environmental studies**
   - Definition, scope and importance.
   - Need for public awareness.

   (2 lecture hours)
2. **Social Issues and the Environment**
   - From Unsustainable to Sustainable development
   - Urban problems related to energy
   - Water conservation, rain water harvesting, watershed management
   - Resettlement and rehabilitation of people; its problems and concerns. Case studies.
   - Envionmental ethics : Issues and possible solutions.
   - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
   - Wasteland reclamation.
   - Consumerism and waste products.
   - Environment Protection Act.
   - Air (Prevention and Control of Pollution) Act.
   - Water (Prevention and Control of Pollution) Act.
   - Wildlife Protection Act.
   - Forest Conservation Act.
   - Issues involved in enforcement of environmental lesislation.
   - Public awareness. (7 lecture hours)
3. **Human Population and the Environment**
   - Population growth, variation among nations.
   - Population explosion - Family Welfare Programme.
   - Environment and human health.
   - Human Rights.
   - Value Education.
   - HIV / AIDS.
   - Women and Child Welfare.
   - Role of Information Technology in Environment and human health.
   - Case Studies. (6 lecture hours)

PART-B

ESSAY TYPE WITH INBUILT CHOICE **50 Marks**

4. **Natural resources :**
   - **Renewable and non-renewable resources :**
     - Natural resources and associated problems.
       - Forest resources : Use and over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
       - Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
       - Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
       - Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer - pesticide problems, water logging, salinity, case studies.
       - Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, Case studies.
       - Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
   - Role of an individual in conservation of natural resources.
   - Equitable use of resources for sustainable lifestyles.

   (8 lecture hours)
5. **Ecosystems**
   - Concept of an ecosystem.
   - Structure and function of an ecosystem.
   - Producers, consumers and decomposers.
   - Energy flow in the ecosystem.
   - Ecological succession.
   - Food chains, food webs and ecological pyramids.
   - Introduction, types, characteristic features, structure and function of the following ecosystem :-
     - Forest ecosystem
     - Grassland ecosystem
     - Desert ecosystem
     - Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

   (6 lecture hours)
6. **Biodiversity and its conservation**
   - Introduction - Definition : genetic, species and ecosystem diversity.
   - Biogeographical classification of India.
   - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
   - Biodiversity at global, National and local levels.
   - India as a mega-diversity nation.
   - Hot-spots of biodiversity.

. Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
. Endangered and endemic species of India.
. Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity. (8 lecture hours)

7. Environmental Pollution

. Definition
. Causes, effects and control measures of :-
- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

. Solid Waste Management : Causes, effects and control measures of
. Role of an individual in prevention of pollution.
. Pollution case studies.
. Diaster management : floods, earthquake, cyclone and landslides.
(8 lecture hours)

PART-C

ESSAY ON FIELD WORK 25 Marks

8. Field work

. Visit to a local area to document environmental assets - river / forest / grass land / hill / mountain
. Visit to a local polluted site - Urban / Rural / Industrial / Agricultural
. Study of common plants, insects, birds.
. Study of simple ecosystems - pond, river, hill slopes, etc.
(5 lecture hours)

(**Notes :** i) Contents of the syllabys mentioned under paras 1 to 8 shall be for teaching for the examination based on Annual Pattern.
ii) Contents of the syllabys mentioned under paras 1 to 4 shall be for teaching to the Semester commencing first, and
iii) Contents of the syllabys mentioned under paras 5 to 8 shall be for teaching to the Semester commencing later.

LIST OF REFERENCES :-

1) Agarwal, K.C., 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email : mapin@icenet.net **(R)**
3) Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
4) Clark R.S., Marine Pollution, Clanderson Press Oxford **(TB)**

5) Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T., 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7) Down to Earth, Certre for Science and Environment **(R)**
8) Gleick, H.P. 1993, Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press. 473p.
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural Histroy Society, Mumbai **(R)**
10) Heywood, V.H. & Watson, R.T. 1995, Global Biodiversity Assessment, Ca mbridge Univ. Press 1140p
11) Jadhav, H & Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi. 284 p.
12) Mckinney, M.L. & Schoch, R.M. 1996, Environmental Science Systems & Solutions, Web Enhanced Edition. 639 p.
13) Mhaskar A.K., Matter Hazardous, Techno-Science Publications **(TB)**
14) Miller T.G.. Jr., Environmental Science, Wadsworth Publishing Co. **(TB)**
15) Odum, E.P., 1971, Fundamentals of Ecology, W.B.Saunders Co., U.S.A., 574p.
16) Rao M.N. & Datta A.K.,1987, Waste Water Treatment, Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
17) Sharma B.K., 2001, Environmental Chemistry, Goel Publ. House, Meerut.
18) Survey of the Environment, The Hindu **(M)**
19) Townsend C., Harper J., and Michael Begon, Essentials of Ecology, Blackwell Science **(TB)**
20) Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media **(R)**
21) Trivedi R.K. and P.K. Goel, Introduction to Air Pollution, Techno-Science Publications **(TB)**
22) Wagner K.D., 1998, Environmental Management, W.B.Saunders Co., Philadelphia, USA 499p.
23) [illegible] **(R)**
24) Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.: Environmental Studies, Pimpalapure & Co., Publishers, Nagpur. **(R)**
25) R.Rajagopalan : Environmental Studies, Oxford University Press, New Delhi, 2005 **(R)**

(M) Magazine
(R) Reference
(TB) Textbook

******

L: Theory Lecture
T: Tutorial
P: Practical
D: Drawing/ Design

APPENDIX-A
FOUR YEAR B.E. DEGREE COURSE
BRANCH : BIOMEDICAL ENGINEERING
SEMESTER PATTERN
SEMESTER: THIRD

ABBREVIAIONS :-
S – Semester
B- Biomedical Engineering, R- Computer Sc. & Engg.
N- Information Technology, U-Electronics & Tele.,
L- Industrial Electronics, E-Electrical, I-Instrumentation

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week	Examination Scheme: Theory — Duration of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment	Total	Practical — Min. Pass Marks	Max. Marks External	Max. Marks Internal	Total Marks	Minimum Pass Marks	Grand Total
1.	3 SB 1	Transforms & Probability	4	1	-	5	3	80	20	100	40	-	-	-	-	
2.	3 SB 2	Human Physiology	4	-	2	6	3	80	20	100	40	25	25	50	25	
3.	3 SB 3/3SI4	Transdusers & Signal Conditioning	4	-	2	6	3	80	20	100	40	25	25	50	25	
4.	3 SRNB 4	Electronic Devices & Circuits	4	-	2	6	3	80	20	100	40	25	25	50	25	
5.	3 SB 5	Bio Physics	4	1	-	5	3	80	20	100	40	-	-	-	-	
		TOTAL	20	2	6	28				500				150		650
		SEMESTER: FOURTH														
1.	4SB1/3SR5	Object Oriented Technologies	4	-	2	6	3	80	20	100	40	25	25	50	25	
2.	4 SB2/4SR3	Analog & Digital ICs	4	-	2	6	3	80	20	100	40	25	25	50	25	
3.	4 SULEIB 3	Network Analysis	4	-	2	6	3	80	20	100	40	25	25	50	25	
4.	4SRULEINB 4	Social Sciences and Engineering Economics	4	-	-	4	3	80	20	100	40	-	-	-	-	
5.	4 SB 5	Biomaterial & Biomechanics	4	1	-	5	3	80	20	100	40	-	-	-	-	
		TOTAL	20	1	6	27				500				150		650

DIRECTION

No. 10/2009 Date : 4/6/2009

Subject : Schemes of teaching & examinations of IIIrd & IVth Semesters of Degree of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern)

Whereas Ordinance No. 4 of 2001 in respect of Examinations leading to the Degree of ([illegible]) Bachelor of Engineering (Four Year Degree Course ..... Semester Pattern), Ordinance, 2001 is in existence in the University,

AND

Whereas the schemes of teaching & examinations of Ist to IVth Semesters of Bachelor of Engineering (Biomedical Engineering) were accepted by the Academic Council vide Item No. 22 B) R-1 in its meeting held on 05-05-2009 and further accepted that the schemes of teaching & examinations of Ist and IInd semesters of Bachelor of Engineering (Biomedical Engineering) course was the same as per the Bachelor of Engineering course which was common for all the branches,

AND

Whereas the schemes of teaching & examinations of IIIrd & IVth Semesters Bachelor of Engineering (Biomedical Engineering) are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of teaching & examinations of IIIrd & IVth Semesters B.E. (Biomedical Engineering) course are to be implemented from the academic session 2009-2010,

AND

Whereas syllabus for IIIrd & IVth Semesters B.E. (Biomedical Engineering) course is to be sent for printing.

Now, therefore, I, Dr.Ku.Kamal Singh, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :-

1) This Direction shall be called "Examinations leading to the Degree of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern), Direction, 2009"

2) This Direction shall come into force from the date of its issuance.

3) Schemes of teaching & examinations for IIIrd & IVth semesters of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern) shall be as per "Appendix-A" appended with this Direction.

Sd/-

Amravati
Dated : 4/6/2009

Dr. Kamal Singh
Vice-Chancellor

DIRECTION

No. 17/2010 Date : 11/06/2010

Subject : Schemes of teaching & examinations of V & VI Semesters of Degree of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern)

Whereas Ordinance No. 4 of 2001 in respect of Examinations leading to the Degree of (illegible) Bachelor of Engineering (Four Year Degree Course ..... Semester Pattern), Ordinance, 2001 is in existence in the University,

AND

Whereas the schemes of teaching & examinations of V & VI Semesters of Bachelor of Engineering (Biomedical Engineering) were accepted by the Academic Council vide Item No. 16 (6) D) R-1) in its meeting held on 20-02-2010,

AND

Whereas the schemes of teaching & examinations of V & VI Semesters Bachelor of Engineering (Biomedical Engineering) are required to be regulated by the Regulation,

AND

Whereas the process of making the Regulation is likely to take some time,

AND

Whereas the schemes of teaching & examinations of V & VI Semesters B.E. (Biomedical Engineering) course are to be implemented from the academic session 2010-2011,

AND

Whereas syllabus for V & VI Semesters B.E. (Biomedical Engineering) course is to be sent for printing.

Now, therefore, I, Dr.Ku.Kamal Singh, Vice-Chancellor of Sant Gadge Baba Amravati University in exercise of powers confirmed upon me under sub section (8) of Section 14 of the Maharashtra Universities Act, 1994, hereby direct as under :-

1) This Direction shall be called “Examinations leading to the Degree of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern), Direction, 2010”
2) This Direction shall come into force from the date of its issuance.
3) Schemes of teaching & examinations for V & VI semesters of Bachelor of Engineering (Biomedical Engineering) (Four Year Degree Course ..... Semester Pattern) shall be as per “Appendix-A” appended with this Direction.

Sd/-
Dr. Kamal Singh
Vice-Chancellor

L: Theory Lecture
T: Tutorial
P: Practical
D: Drawing/ Design

APPENDIX-A
FOUR YEAR B.E.DEGREE COURSE
BRANCH : BIOMEDICAL ENGINEERING
SEMESTER PATTERN
SEMESTER: FIFTH

ABBREVIAIONS :-
S – Semester
B- Bio Medical Engineering
R- Computer Science & Engg.
N- Information Technology
I - Instrumentation Engg.

Sr. No.	Sub. Code No.	SUBJECT	Teaching Scheme L	T	P/D	Total Hours/ Week	Examination Scheme Theory Duration of Papers (Hrs)	Max. Marks Theory Papers	Maximum Marks College Assessment	Grand Total	Practical Min. Pass Marks	Max. Marks External	Max. Marks Internal	Total Marks	Minimum Pass Marks
1.	5 SB 1	Data Structures & Algorithms	4	-	2	6	3	80	20	100	40	25	25	50	25
2.	5 SB 2	Bio Control Systems	4	1	-	5	3	80	20	100	40	-	-	-	-
3.	5 SB 3	Bio Medical Instrumentation	4	-	2	6	3	80	20	100	40	25	25	50	25
4.	5SULB4	Communication Engineering	4	1	2	7	3	80	20	100	40	25	25	50	25
5.	5 SB 5	Pathology & Microbiology	4	-	-	4	3	80	20	100	40	-	-	-	-
6.	5 SRNB 6	Communication Skills	2	-	2	4	2	40	10	50	20	25	25	50	25
		TOTAL	22	2	8	32				550				200	750
		SEMESTER: SIXTH													
1.	6SB1	Diagnostics & Therapeutic Equipments	4	-	-	4	3	80	20	100	40	-	-	-	-
2.	6SIB2	Basic Industrial Management	4	-	-	4	3	80	20	100	40	-	-	-	-
3.	6SB3	Microprocessors & Applications	4	-	2	6	3	80	20	100	40	25	25	50	25
4.	6SB4	Radiological Equipments	4	1	-	5	3	80	20	100	40	-	-	-	-
5.	6SB5	Physiological Modelling & Simulation	4	-	2	6	3	80	20	100	40	25	25	50	25
6.	6SB6	Medical Instrumentation Laboratory	-	-	2	2	-	-	-	-	-	25	25	50	25
		TOTAL	20	1	6	27				500				150	650

Note : Hospital visit is compulsory and students are required to submit the report during Sixth Semester failing which term will not be granted.

FIFTH SEMESTER

5 SB 1 DATA STRUCTURES & ALGORITHMS

(8 hrs/unit)

Unit I : Data structures basics, Mathematical/algorithmic notations & functions, Complexity of algorithms, Sub algorithms. String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.

Unit-II : Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, Bubble sort, Linear search and Binary search algorithms. Multidimensional arrays, Pointer arrays. Record structures & their memory representation. Matrices & sprase matrices.

Unit-III : Linked lists and their representation in memory, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion deletion operations on linked lists. Header linked lists, Two- way linked lists.

Unit-IV: Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, an application of stacks, Recursion. Tower of Hanoi problem. Implementation of recursive procedures by stacks, Queues. Dequeues. Priority queues.

Unit-V: Trees, Binary trees & and their representation in memory, Traversing binary trees. Traversal algorithms using stacks, Header nodes: threads. Binary search trees, searching, inserting and deleting in binary trees. Heap and heap sort. Path length & Huffman's algorithm. General trees.

Unit-VI: Graph the<j>ry, sequential representations of graphs, Warshalls' algorithm, Linked representation, operat~ons & traversing the graphs. Po sets & Topological sorting. Insertion Sort, Selection Sort. Merging & Merge-sort, Radix sort, Hashing.

Textbook :

Seymour Lipchutz: "17heory & Problems of Data Structures" Schaum's Outline series(TMH).

References:

I. Ellis Horowitz, Sartaj Sahni - Fundamentals of Data Structures (CBS Publications)

2. Trembley, Sorenson:- An Introduction to Data Structures with Applications.(TMH)

3. Aho Ullman: Analysis and Design of Algorithms.(Pearson)

4. Bhagat Singh, Naps: Introduction to Data Structures. (Galgotia)

DATA STRUCTURES & ALGORITHMS- LABORATORY

The sample list of program is given below. This list can be used as guide line for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

I. Write an application to implement Tower of Hanoi Problem Algorithm.
2. Write an application to implement Abstract data type stack.
3. Write an program to evaluate Post fix expression using stack.
4. Write a program to implement Abstract data type queue.
5. Write a program to implement singly linked list that performs various operation such as insertion. deletion, searching a node in linear linked list.
6. Write a program to implement Preorder Traversal of a binary tree.
7. Write a program to search a given element using Binary Search.
8. Write a program to implement Selection Sort.
9. Write a program to implement Merge Sort.
10. Write a program to perform insertion or search in a specified level of a stack implemented tree-structured symbol table..

5 SB 2 BIO CONTROL SYSTEM

Unit I : CONTROL SYSTEM MODELLING.

System concept, Differential Equations, Transfer functions, Modelling of electrical systems, Translational and rotational mechanical systems, Electto-mechanical systems, physiological systems, block diagram modelling, signal flow graphs.

Unit II : TIME RESPONSE ANALYSIS

Time domain specifications, step and Impulse response analysis of first order and second order systems, steady state errors, stability, Routh-Hurwitz criteria, Root locus techniques, construction of root locus, stability, dominant poles, applications of Root locus diagram.

Unit III: FREQUENCY RESPONSE ANALYSIS

Frequency response, Bode plot-Nyquist plots, Nyquist stability criterion, Relative stability, Gain margin, phase margin, bandwidth magnitude plots, constant circles, Nichol's chart

Unit IV: PHYSIOLOGICAL CONTROL SYSTEMS

Introduction to physiological control systems, modelling of human movements, parameter estimation, linearizing

Unit V : STUDY OF BIOLOGICAL SYSTEMS

Human Thermal system, Neuro muscular system, Respiratory

system, occulomotor system.

Unit VI: State space representation of systems, conversion of state variable models to transfer functions,conversion of transfer functions to state variable models, solution of state equations, concepts of controllability and absorbability.

REFERENCES

1. M.Gopal, 'Control Systems', Principles and Design, Tata McGraw-Hili, 1997.
2. Benjamin. C.Kuo, ' Automatic Control Systems', Prentice Hall of India, 1995.
3. Manfreclyner and J.,hn H.Milsum, Bio Medical engineering system, McGraw-Hili and Co., Neo York, 1970.

5 SB 3 BIOMEDICAL INSTRUMENTATION

Unit I: Introduction to Biomedical Instrumentation Sources of biomedical potentials
Electrical activity of excitable cells
Resting and action potential
Bioelectric potentials.
Origin of bioelectric signals like ECG, EEG, EMG.

Unit II : Biopotential electrodes
Basic electrode theory
Nerenst equation
Electrical conductivity of electrode jellies and cream
Skin contact impedance and its measurement
Electrodes for ECG, EEG and EMG.
Recording electrodes

Unit III : Cardiovascular systems
Physiology of heart
ECG lead configuration
Blood Pressure
Characteristics of blood flow
Measurement of blood flow and cardiac output.

Unit IV : Nervous system
Classification of Nervous system
Anatomy of Nervous system
Organisation of Brain
Neuronal communication
Neuronal receptors
Sematic and Autonomic nervous system Spinal reflexes .
Neuronal firing measurements
EEG measurement

Unit V : Measurement of Respiratory system
Modeling the respiratory system
Measurement of Gas Flow rate
Measurement of Pressure
Respiratory Plethysmography
Measurement of Gas concentration
Measurement of Oxygen concentration

Unit VI: Physiological effects of Electricity
Leakage current, Types of leakage current
Macroshock Hazards
Microshock Hazards
Electrical safety analysis
Basic approaches to protection against shock
Protection : Power Distribution
Protection : Equipment Design

REFERENCE BOOKS:

I) R.S.Khandpur : Biomedical Instrumentation
2) Cromwell : Biomedical Instrumentation
3) John G. Webstar. : Biomedical Equipments

5 SB 3 Practicals: Based on above Syllabus.

5 SULB 4/ 5 SUL 4 COMMNUNICATION ENGINEERING

SECTION-A

Unit I : AM Transmitters : Modulation, need of modulation, AM Modulation, Frequency spectrum, Principles of DSB-FC, DSB-SC, SSB-SC modulation and their comparison, Details of DSB-FC Transmitter, Generation of DSB-SC by using balanced modulators (FET & Diodes), DSB-SC Transmitter.. Generation of SSB-SC by phase-shift method.

Unit II : AM Receivers : TRF receiver, Superhetrodyne receiver, Details of each block such as RF amplifier, mixer oscillator, IF amplifier, Diode detector, Audio Amplifier.

Need and type of AGC, Practical Radio Receiver Circuit with AGC, Characteristics such as selectivity, sensitivity, fidility communication receiver.

Unit III : FM Transmitters : FM Modulation, Frequency Spectrum, Circuits & Analysis for direct FM generation using FET and varactor diode. Circuit & analysis of Indirect FM generation, Narrow Band and Wide Band FM, their comparision, De-emphasis and pre- emphasis. FM Transmitter & stereo FM Transmitter.

SECTION-B

Unit IV : FM Receivers : Details of FM receiver, blocks such as R.F. amplifier, local oscillator, IF amplifier, Mixer, Audio Ampl., AGC, Limiter, FM Discriminator, Single Slope and Balanced slope detector, Analysis of Foster seeley and ratio detectors, Stereo FM receiver.

Unit V : Monochrome TV : Basic television system, simultaneous sound and picture transmission, scanning process, composite video signal, signal transmission and channel bandwith, camera tubes, TV receiver; Block diagram and functional requirements, Basic concept of colour TV.

Unit VI : Satellite Communication : Orbital satellites, Geostationary Satellites, Orbital patterns, Look angles, satellite system link models, Transponder, Up link, Down link, cross link, satellite system parameters, Radiated power.

PRACTICALS : Minimum 8 practicals based on above syllabus, preferably uniformly distributed.

BOOKS :

1) Kennedy G. : Electronics Communication System, Tata McGraw Hill Co.,New Delhi (Third Edition), 1985.
2) Young P.H. : Electronics Communication Techniques, Coloumbus, A Bell and Howell Co. (First Edition)
3) Martin James : Telecommunication and the Computer, Prentice Hall Inc. New Jersey (Third Edition), 1972.
4) Roddey D., Coolen S. : Electronics Communication, Prentice Hall India Pvt. Ltd. (Third Edition), 1983.
5) Beck, Robert and J. Schoen : Electronics Communication, Modulation and Transmission, A Bell and Howell Co., Indiana.
6) Murphy R.J. : Telecommunication Network, Hiward W., Sams & Co., 1987.
7) Dhake : TV Engineering.
8) Agrawal D.G. : Satellite Communications, Khanna Publication.
9) William D. Stenley and John M. Jeffords : Electronic Communications Principles and Systems, Cengage Learning Pub. Company.
10) Roy Blake : Electronic Communications Systems, Cengage Learning Pub. Company.

5 SB 5 PATHOLOGY & MICROBIOLOGY

Unit I: NORMAL CELL $TRUCTURE

Cell Degeneration and regeneration - Inflammations, apoptosis, Neoplasia. Classifi~ation,

Difference between benign and malignant nn110f.§

Etiology of tumors - Spread of Tumors.

Unit II: FLUID AND HEAMODYNAMIC DERANGEMENT Edema, Shock, Hemorrhage - Thrombus - Embolism - Disseminated intra vascular Coagulation - Hematological disorders. Bleeding Disorders - Leukemia - lymphoma.

Unit III: GENETIC DISORDERS, INFECTION AND IMMUNITY

Autosomal and Sex linked disorders - Storage disorders - Types of hypersensitivity reactions - Immune deficiency Syndrome - Primary - HIV - Viral disease. Chlamydial -Bacterial - mycoplasma - Rickettsial disease - Fungal, protozolal. - Helminthic disease.

Unit IV: General Structural Organization of Bacterial, Viral Cell- Growth and Identification of Bacteria, Observation of culture.

Microscopy: - Light Microscopy - Dark field Microscopy - Phase contrast microscopy -electron microscopy.

Unit V: . Identification of disease producing organism, Simple Stain, Gram Stain, AFB Stain, Fluorescent techniques, Antigen-Antibody Technique

Unit VI: CARDIO VASCULAR DISEASES

- Ischaemic Heart Disease Rheumatic heart Disease Valvular Heart Disease Hypertension Cardiomyopathy Infective Endocarditis. Congestive Cardiac Failure Diseases of Pericardium. - Cardiogenic Shock.

TEXT BOOKS

1. Robbins S.L & Ramzi S.C, “Pathologic Basis of Diseases’, W.B. Saunders Co. 1999
2. Anatha Narayanan.R & Jayaram Panicker C.R, ‘Text Book of Microbiology, Orient Laongman’ 1998.

5 SRNB 6/ 5SRN6 COMMNUNICATION SKILLS

Unit I : Comprehension over an unseen passage.

Comprehension - A - word study :-

Synonym, antonym, meanings, matching words, adjectives, adverbs, prefix and suffix, correct forms of commonly misspelled words, understanding of the given passage.

Comprehension - B - Structure study :-

Simple and compound sentences, types of conjunctions, singular and plural, tenses and their effect on verb forms. Use of - not only - but also, if clause, since, may, can, could, would, too etc.

Active and passive forms, negative and interrogative, punctuation and capitalization. (10 Hours)

Unit II : Theoretical background - importance of communication, its process, model of communication its components & barriers.

Verbal communication, its significance, types of written communication, organization of a text (Titles, summaries, headings, sequencing, signaling, cueing etc.), Important text factors (length of paragraph, sentences, words, clarification and text difficulty). Evaluation of written communication for its effectivity and subject content.

Non-verbal communication, types of graphics and pictoral devices. (10 Hours)

Unit III : Specific formats for written communication like - business correspondence, formal reports, technical proposals, research papers and articles, advertising and graphics. Format for day-to-day written communication like applications, notices, minutes, quotations, orders, enquiries etc.

Oral communications - Important objectives of interpersonal skills, (verbal and non-verbal), face to face communications, group discussion and personal interviews.

Methodology of conduction of meetings, seminars, symposia, conference and workshop. (10 Hours)

BOOKS RECOMMENDED :

1) Krishna Mohan, Meera Banerjee : Developing Communication Skills, MacMillan India Limited.
2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
3) Curriculum Development Centre, TTTI WR, Bhopal : A Course in Technical English, Somaiya Publication Pvt. Ltd.
4) F.Frank Candlin : General English for Technical Students, University of London Press Ltd.
5) Barunk Mitra, Effective Technical Communication, Oxford University Press
6) Meenakshi Raman & Sangeeta Sharma, Technical Communication Principles & Practice, Oxford University Press

COMMUNICATION SKILLS LABORATORY

Objective :

On completion of this laboratory the candidate should be able to demonstrate adequate skills in oral and written communication for technical English language, actively participate in group discussions and interviews and exhibit the evidence of vocabulary building. Candidates should be assessed through continuous monitoring and evaluation.

The sample list of experiments is given below. This list can be

used as guideline for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

1. Assignments and tests for vocabulary building
2. Technical report writing
3. Group discussions
4. Interview techniques
5. Projects and tasks such as class news letter
6. Writing daily diaries and letters
7. Interactive language laboratory experiments.

TEXT BOOK : Norman Lewis : Word Power Made Easy

http://www.teachingenglish.org.uk

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SEMESTER : SIXTH

6 SB I DIAGNOSTIC & THERAPEUTIC EQUIPMENTS

DIAGNOSTIC EQUIPMENT

Unit I: Introduction to Biomedical Recorder

ECG recorder, Microprocessor based ECG machnies, Multichannel ECG machine

Vector cardiograph, phono cardiograph, Heart sound

EEG recorder, EMG recorder

Unit II : Medical Imaging System

Instrumentation for diagnostic X-Ray

Properties of X-Ray units, X-Ray machines and generation process

Special emaging teclmiques for X-Rays

Computed Radiography, Computed Tomography

Ultrasonic imaging system, Physics of ultrasound

Basic modes of transmission

Ultrasonic display modes - Ascan, Bscan, Mscan with applications, Ultrasonography

Unit III : Patient Monitoring system

System concept

Bedside patient monitors

Central monitors

Average reading heart monitor

Intensive care monitoring

Ambulatory monitory

Biotelemetry: Single channel & multichannel telemetry, telephone & computer based telemetry

THERAPEUTIC EQUIPMENTS

Unit IV : Cardiac Pacemaker, Types of Pacemaker
External Pacemaker
Implantable Pacemaker, Types & Implantable Pacemaker Leads & electrodes, pacing system analyser
Ventricular synchronous demand Pacemaker Programmable Pacemaker
Reliability aspects of cardiac Pacemaker
Power sources of implantable Pacemaker

Unit V : Cardiac Defibrillator
DC - defibrillator
Defibrillator electrodes
Defibrillator analyser
Implantable Defibrillator Cardioverters
Ventilators, High frequency ventilators Muscle stimulator

Unit VI : Physiotherapy & Electrotherapy equipment Shortwave diathermy machine Microwave diathermy machine Ultrasonic therapy unit
Therapeutic apparatus
Surgical diathermy machine
Electrodes used with surgical diathermy Infant incubators
Therapeutic application of laser

Text Books:

I) R.S.Khandpur: Handbook of Biomedical Instrumentation, TMH Pub.
2) Cromwell L., Wibell F. w., Pfciffer E.A. : Biomedical Instrumentation & Measurements, PHI Pub. 3) Timpkins W.J. : Biomedical Digital Signal Processing.

Reference Books :

I) Carr & Brown: Introduction to Biomedical Equipment.
2) Webster J.G. : Medical Instrumentation, 3rd edition, John Wiley.

6 SIB 2/ 6 SI 2 **BASIC INDUSTRIAL MANAGEMENT**

Unit I : Principles and techniques of management : meaning of and differences among business, management, administration and organisation, Principles of management, functions of management, planning, organisation structure and relationships, direction, co-ordination, control, motivation, delegation and decentralisation, communication, leadership and decision making.

Unit II : Market and materials management :

A) Marketing strategy, market research, consumer behaviour, advertising and sales promotion, channels of distribution, pricing of products.

B) Classes of material, scope of material control, scope of purchasing department, purchasing procedures, order procedures, inventroy control, introduction to production, planning and control.

Unit III: Personnel management :

Meaning and functions of personnel management, recruitment, selection, promotion, wages and salary administation, training and development, functions and scope of trade unions in Indian industries. Welfare of labour, Problems of labour turn over & retention.

Unit IV : Project and financial management :

A) Case studies of project report, preparation of profit and loss statement and balance sheet, ratio analysis.

B) Principles of costing, cost sheet preparation, variance analysis, meaning and application of various budgets, types of budgets and their importance.

Unit V : Industrial ownership : types, single partnership, JSC, co-operative, public sector, private sector, merits & demerits.

Enterpreneural qualities, skills, role of government, financing agencies.

Unit VI : Quality management :

Concepts and applications of Kaizen, quality circle, ISO 9000 series, just-in-time, quality planning and total quality management, elements of TQM, Quality Circles.

BOOKS RECOMMENDED :-

1) Koontz H., O'Donnel C. and Whierich : Principles of Management, Tata McGraw Hill Puslishing Co. Ltd., New Delhi.
2) Khanna O.P. : Industrial Engineering and Management.
3) Mody Suresh M. : Total Quality Management, D.L.Shah and Trust, Mumbai
4) Sherlekar S.A. : Business, Organisation and Management, Himalaya Pub. House Ltd., Mumbai.
5) Gupta P.B. & Sharma P.B. : Industrial Management & Managerial Economics, Ratnasagar Pvt. Ltd., New Delhi.
6) Khanka : Entrepreneurial Development, S.Chand & Co., New Delhi.
7) Mahajan S.M. : Statistical Quality Control.

6 SB3 **MICROPROCESSORS AND APPLICATIONS**

(8 hrs/unit)

Unit I: 8086 architecture and pin configuration, Software model of 8086 microprocessor. Memory addresses space and data organization. Data types. Segment registers, mem(i)ry segmentation. IP & Data registers, Pointer, Index registers. Memory addresses generation.

Unit II: 8086 Instruction set overview, addressing modes. 8086 instruction formats. 8086 programming : Integer instructions and computations: Data transfer instructions, Arithmetic instructions and their use in 8086 programming.

Unit III: 8086 programming: logical instructions. Shift and rotate instructions and their use in 8086 programming. 8086 flag register and Flag control instructions, compare instruction, control flow and jump instructions, Loops & loop handling instructions. 8086 programming using these instructions.

Unit IV: The 8086 stack segment and stack related instructions. 8086 I/O Address space. Subroutines and related instructions, Parameter passing, Concept of Macros, Status saving on stack. Concept of recursion at assembly program level. 8086 Programming using subroutines, recursion and macros.

Unit V: 8086 I/O: Types of input output, isolated I/O interface. input output data transfers, I/O instructions and bus cycles. Programmable Peripheral Interface 8255 PPI: pin diagram, internal organization, modes of operation. 8086 I/O programming using 8255.

Unit VI: 8086 Interrupts types, priority and instructions. Interrupt vector table, External hardware-interrupt interface signals & interrupts sequence. Software interrupts. Non-maskable interrupts. Programmable Interrupt Controller 8259: pin diagram, internal organization, modes of operation. 8086 Interrupt-driven programming using 8259.

TEXT BOOKS:

I. W. A. Triebel & Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)

2. Liu & Gibson: The 8088/8086 Microprocessor (2/e) (PHI)

REFERENCES:

I. Barry B. Brey : The Intel Microprocessor Architecture, Programming & Interfacing (6/e)(PHI)

2. Ray & Bhurchandi: Advanced Microprocessors & Peripherals (TMH).

3. John P Utfenbeck, "8086/8088 Families: Designing, Programming and Interfacing". Prentice Hall .

6 SB3 MICROPROCESSORS AND APPLICATIONS LABORATORY

The sample list of program is given below. This list can be used as guide line for problem statements but the scope of the laboratory should not be limited to the same. Aim of the list is to inform about minimum expected outcomes.

. Write a program in TASM to manipulate the two given operands with general arithmetic operators +, -, *, *I* and store the result at the given location 2000H to 2003H respectively.

. Write an instruction sequence that generates a byte size integer in the memory location defined as RESULT. The value of the integer is to be calculated from logical equation [RESULT] = [AL] * [NUM 1]+ [Nl,IM2] * AL + BL

. Assume that all parameters are byte- sized. NUM I, NUM2 and RESUL T are the offset addresses of the memory location in the current data segment.

. Given a number XY, write a program using T ASM to store OX in BX register and OY in ex register.

. Write a T ASM program to sort the elements using Bubble Sort Algorithm.

. Write a program in T ASM to search for a single item from a list of elements using Binary Search Algorithm. Show that if the element is found or not.

. Write a program in TASM to convert the given binary number into decimal number. The unsigned eight-bit value is stored in variable BINV AL; the three-digit ASCII result is stored in three memory locations HUN, TEN & ONE.

. Given 16-bit binary number in OX, write a program that converts it into its equivalent BCD number. If result is bigger than 16-bit, place aliI's in OX

. Write a program using T ASM by using DOS INT 2 I H, function 09H to display string. The string to be displayed must have a '$' as its last character. The string address of the string must be loaded into register OX and the string must reside within current data segment.

. Write a program using T ASM to echo command line text to the screen using INT 21 H, function 02H.

. Write a program using T ASM to read the date maintained by the system and return the following information using DOS INT 2 I H, function 2AH.

DH = Month

DL = Day of month

CX=Year

AL=Day of the week

. Using DOS INT 21 H function 08H write a program in T ASM to obtain a secret Password from user. The password is not echoed to the screen. The password is stored in PWTXT and may be of any length, but must be terminated by a carriage return.

6 SB 4 RADIOLOGICAL EQUIPMENTS

Unit I: X-Rays: principles and production of soft and hard X-rays, selection of anodes, Heel pattern, scattered radiation. Porter Bucky system, Cooling system, Origin and nature of X-rays and nuclear medicine equipment, Types and uses of X-ray. Nature and types of Nuclear radiation. Block diagram and operation of X-ray machine

Unit II: Radio-diagnosis

Radiography. Angiography, Fluoroscopy, Image intensifier, Multi section radiography, Instrumenation for the medical use of radioisotopes. Units for measuring radioactivity, Nuclear medicine machine, Computer system used in X-ray & Nuclear medicine equipment.

Unit III : Special Radiological Equipment: principle, plane of movement, multi section radiography, CAT, principle of NMR, MRI, Image reconstruction teclmiques, basic NMR components, applications, Advantages & disadvantages ofNMR, Imaging teclmiques, Biological effects ofNMR imaging computed tomography, computed radiography.

Unit IV : Application of Radioisotopes : Alpha, Beta and Gamma emission, principle of radiation detectors, dot scanners,

Nuclear Angiogram, principles of radiation therapy, radiation thennometry, radiation sources, radiation sensors.

Unit V: Medical Ultrasonography: Ultrasound, Physics of sound and ultrasound waves, ultrasound transducer, scan modes and scanning systems, Biological effects of ultrasound. Flow meters, ultrasonic blood pressure measurement, ultrasonic scanner.

Unit VI : Radiation Safety: Hazardous effect of radiation. Radiation protection techniques, Safety limits radiation monitoring.

TEXT BOOKS:

I) R.S.Khandpur : Handbook of Biomedical Instrumentation
2) Carr and Brown : Biomedical Instrumentation
3) Steve Webb : The Physics of Medical Imaging.

6 SB 5 PHYSIOLOGICAL MODELLING & SIMULATION

Unit I: Introduction to physiological control systems, Art ofmodellling physiological systems, Linear models of physiological systems, distributed parameters versus lumped parameter models. Principle of superposition.

Unit II : Cardiovascular system modeling and simulation: Theoretical basis, model development, heart model, circulatory model. Computational flow diagrams of cardiac system. Software development.

Unit III : Pulmonary mechanics modeling & simulation: Theoretical basis, model development, lung tissue viscoelastance, chest wall, airways-full model of respiratory mechanics, Pulmonary system software development - computational flow diagram.

Unit IV : Interaction of Pulmonary and cardiovascular models, computational flow diagram for cardiopulmonary, software development, Eye movement system, Oculomotor muscle model and linear muscle model.

Unit V: Simple models of muscle stretch reflex action, Ventilatory control action, lung mechanics and their simulink implementation. Frequency domain analysIs oflinearize model ofIungs mechanics, circulator control model and glucose insulin regulation model by MATLAB Tool.

Unit VI : Study of steady state analysis ofmusc1e stretch reflex action. Ventilatory control action by MATLAB tools.

Study of transient response analysis of neuromuscular reflex model action by MATLAB tools.

TEXT BOOKS:

1) Michael C.K.Khoo: Physiological Control System: Analysis Simulation & Estimation
2) Jon B. Olansen & Eric Rosow : Virtual Bioinstrumentation, Biomedical, Clinical and Health Care Application.

6 SB 5 Practicals : Based on above syllabus.

6 SB 6 MEDICAL INSTRUMENTATION LAB.

Lab. based on 6 SB I Diagnostic & Therapeutic Equipments and 6 SB 4 Radiological Equipments.

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SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
*** ORDINANCE NO. 42 OF 2005**

Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005

Whereas it is expedient to frame an Ordinance relating to Examination in Environmental Studies leading to Bachelor Degree level, hereinafter appearing, the Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be called "Examination in Environmental Studies leading to Bachelor Degree, Ordinance, 2005."

2. This Ordinance shall come into force from the Academic session 2005-06.

3. In this Ordinance and in other ordinances relating to the examination, unless there is anything repugnant in the subject or context :-

   (i) "Academic session" means a session commencing on such date and ending with such date of the year following as may be appointed by the Management Council.
   (ii) "Admission to an examination" means the issuance of an admission card to a candidate in token of his having complied with all the conditions laid down in the relevant ordinance, by a competant officer of the University.
   (iii) "Applicant" means a person who has submitted an application to the University in the form prescribed for admission to an examination.
   (iv) "Candidate" means a person who has been admitted to an examination by the University.
   (v) "Regular Candidate" means an applicant who has applied for admission to a Univeristy examination through an affiliated college, Department or Institute in which he/she has prosecuting a regular course of study.
   (vi) "Examinee" means a person who present himself/herself for an examination to which he/she has been admitted.
   (vii) "Examination" means an examination prescribed by the University under the relevant Ordinance.
   (viii) "External Candidate" means a candidate who is allowed to take a University examination in accordance with the provision of Original Ordinance No. 151.

   (ix) " Non-Collegiate Candidate" means a candidate who is not a collegiate candidate.
   (x) An "Ex-student" is a person who having once been admitted to an examination of this University, is again required to take the same examination by reason of his failure or absence thereat and shall include a student who may have joined a college, Department or Institute again in the same class.
   (xi) "Bachelor Degree Examination" means a examination leading to Bachelor Degree of the University.
   (xii) "Previous Year" means a year following by final year of Bachelor Degree.

4. Save as otherwise specifically provided, the conditions prescribed for admission to the examination under this Ordinance shall apply to all persons who wish to take the examination to the Degrees of the University mentioned in para 5 below.

5. The conditions prescribed for admission to examination under this Ordinance shall apply to following degrees of the University :-

   1) Bachelor of Arts
   2) Bachelor of Performing Arts
   3) Bachelor of Fine Arts
   4) Bachelor of Mass Communication
   5) Bachelor of Social Work
   6) Bachelor of Commerce
   7) Bachelor of Business Administration
   8) Bachelor of Science
   9) Bachelor of Computer Science
   10) Bachelor of Computer Applications
   11) Bachelor of Pharmacy
   12) Bachelor of Science (Home Science)
   13) Bachelor of Technology (Cosmetics)
   14) Bachelor of Engineering
   15) Bachelor of Engineering (Part Time) (Civil)
   16) Bachelor of Textile
   17) Bachelor of Technology (Chemical Technology)
   18) Bachelor of Technology (Chemical Engg.)
   19) Bachelor of Architecture, and
   20) Bachelor of Laws (Five Year Course)

6 i) Environmental Studies shall be a compulsory subject for a previous year examination of the following Bachelor Degrees of the University,

1) Bachelor of Arts
2) Bachelor of Performing Arts
3) Bachelor of Fine Arts
4) Bachelor of Mass Communication
5) Bachelor of Social Work
6) Bachelor of Commerce
7) Bachelor of Business Administration
8) Bachelor of Science
9) Bachelor of Computer Science
10) Bachelor of Computer Applications
11) Bachelor of Pharmacy
12) Bachelor of Science (Home Science)
13) Bachelor of Technology (Cosmetics)
14) Bachelor of Engineering (Part Time) (Civil)

ii) Environmental Studies shall be a compulsory subject for IIIrd & IVth Semester of the following Bachelor Degrees of the University,
1) Bachelor of Engineering
2) Bachelor of Textile
3) Bachelor of Technology (Chemical Technology)
4) Bachelor of Technology (Chemical Engineering)
5) Bachelor of Architecture, and

iii) Environmental Studies shall be a compulsory subject for Vth & VIth Semester of the Degree of Bachelor of Laws (Five Year Course)

iv) Students admitted to Second Year/Third Year/IVth Semester/ VIth Semester of various degree examination courses in different Faculties in the academic session 2005-06 or thereafter shall have to appear for examination in the subject Environmental Studies.

7. The main examination leading to Environmental Studies shall be held in Summer and supplementary examination in Winter every year, at such places and on such dates as may be appointed by Board of Examinations.
Explanation:- Examination shall be conducted on the basis of one common question paper for all Bachelor Degree Examination courses irrespective of annual or semester pattern.

8. Scope of the subject for annual pattern examination and or semester pattern examination shall be as provided under the syllabus.

9. Common question paper for all courses covered under this Ordinance alongwith answer books shall be supplied by the University to the Colleges, Departments and Institutes for conducting the examination of

the subject.

10. Valuation of the answer books relating to this subject shall be done at College/Department/Institution level only. Remuneration for valuation of answer books shall not be paid by the University.
Provided that prescribed evaluation fee for evaluation of each answer book/s of an external examinee/s appeared from the examination centre shall be paid to each examination centre.

11. It shall be obligatory on the part of the College/Department/Institute to submit candidate wise following information to the University on or before the date as may be prescribed by the University :-

Sr. No.	Grade/Category	Marks secured
1.	"A"	- 60 and above
2.	"B"	- 45 to 59
3.	"C"	- 35 to 44
4.	"D"	- 25 to 34
5.	"Fail"	- 24 and below
6.	"Absent"	

12. For the purposes of teaching, learing and examination, the Committee consisting of three teachers shall be appointed by the Principal/ Head of the Department/Head of the Institution under his/her Chairmanship/ Chairpersonship. While appointing three teachers on the said committee, the Principal shall take care that the teachers to be appointed on the committee, if necessary, shall be from different faculty.

13. i) Duration of theory examination of this subject shall be three hour.
ii) For all Bachelor Degree examinations, common question paper of 100 marks shall be provided by the University.
iii) Distribution of these 100 marks shall be as follows :-
a) Part-A, Short Answer Pattern - 25 Marks
b) Part-B, Essay type with inbuilt choice - 50 Marks
c) Part-C, Essay on Field Work - 25 Marks

14. Medium of instruction shall be English or Marathi or Hindi. Question paper shall be supplied in English and Marathi and Hindi. A candidate shall have option to write answers in English or Marathi or Hindi.

15. Examination for the subject Environmental Studies shall be compulsory for external candidates appearing as a fresh candidate at Winter and/or summer examination.

16. For teaching of the subject, there shall be atleast two hour per week. For teaching the subject to the regular candidates, a full time approved teacher of the University and or a person having Postgraduate Degree in any faculty with second class shall be considered elligible.

17. For teaching of the subject, additional fee to be charged to regular candidate shall be as prescribed by the University.

18. Every College/ University Teaching Department shall charge additional fee of Rs. 100/- to every Student of the subject Environmental studies. Out of this Rs. 100/-, the College/University Teaching Department shall have to pay Rs. 25/- to the University as an examination fee of each candidate for the subject environmental studies.

19. The Grade secured by an examinee in the examination of this subject shall not be considered for providing the facility of A.T.K.T. in next higher class.

20. The provisions of Ordinance No. 18/2001 shall not be applicable for securing a grade or higher grade in the examination of this subject.

21. Result of the Final Year of the respective Degree shall not be declared of an examinee unless he/she secures any one of the grade in the examination of subject.

    Provided an examinee admitted to Five Year LL.B. course desiring not to continue his/her education beyond Sixth Semester of the said course shall have to secure any one of the grade in the examination of the subject otherwise his/her result of Sixth Semester for awarding B.A. degree shall not be declared.

22. Certificate shall be issued, to the successful examinees in the subject Environmental Studies, after the examination.

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