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

visit us at www.sgbau.ac.in

Price Rs. 12/-

© "No part of this prospectus can be reprinted or published without specific permission of Sant Gadge Baba Amravati University."
SYLLABUS
PRESCRIBED FOR
FOUR YEAR DEGREE COURSE
B.E. BIOMEDICAL ENGINEERING
IIIrd & IVth SEMESTER EXAMINATIONS
SEMESTER PATTERN
THIRD SEMESTER

Inplant 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 strictly 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 proceeding 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 correspondence,

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 (1D only) and Wave Equation (1D only).

Unit III: Calculus of Complex Variables: 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:
2. Lakshminarayan- Engineering Math 1.2.3
3. Prasad: Partial Differential Equations, New Age International
7. Deo N: Graph Theory with Applications to Engineering and Computer Science - Prentice Hall.
Unit I  Basic Biological (Biophysical & Biochemical) Principles:

Unit II  Genetics:

Unit III  Blood Vascular system

Unit IV  Muscular Physiology:

Unit V  Neuro Physiology:

Unit VI  Cardio Vascular System
blood group, Blood clotting, Cardiac cycle and cardiac output, Blood Pressure - regulation & controlling factors.

Renal System: Function of kidney, Anatomy & Histology of Nephron & collecting duct. - Urine formation (Filtration, reabsorption 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
2. Textbook of Physiology by Chattergi

3SB3 / 3SI4 TRANSDUCER AND SIGNAL CONDITIONING

SECTION A

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

UNIT II: Displacement, Force & 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)


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, Anemometer, 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: Psychrometer, Hygrometer (Hair, wire & Electrolysis 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. Calibration of pt-100.
3. a) Calibration 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 psychrometer.

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 SRN4 ELECTRONIC DEVICES & CIRCUITS

SECTION A

UNIT I: Diodes: Characteristics of semiconductor diodes, diode resistance. Rectifying circuits & do power supplies, HWR, FWR, BR, comparison. Filter circuits for power supplies: Inductor, Capacitor, LC, IT Filters.
UNIT II : Concept of amplification, $A_i$, $A_v$ and $A_p$; $R_i$, $R_o$. Conversion efficiency. Basic transistor operation, Basic characteristics of transistor amplifier. Transistor input characteristics, $C_B$ amplifier, $C_C$ amplifier.


SECTION-B

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


Text Books :
1. Malvino : Principles of Electronics (TMH)

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). monophasic and biphasic recordings, original and propagation of excitation & contraction, refractoriness, regular and ectopic pace makers, electrocardiography, waveform and measurement, 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, electrodromyography, recording electrodes, interfaces, skin contact impedance, biological transducers, receptor potentials.

Unit IV :- Introduction to electrical simulation: Properties of nerve fibers - excitability, conductivity, all-ornone law, accommodation, adaptation, summation, refractory period, indefatigability 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


Text books
2. Massey and Meredith, Medical Physics.

Reference books
2. Patrick Rcully, Electrical Simulation & Electropathology, Cambridge University press
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 III. Inheritance in C++ : Derived class & base class, Derived class constructors, Function overloading, class hierarchies, Public and private inheritance, Multiple inheritance. Containment : 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.


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

References :
1. Bjarne Stroustrup 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 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 planar 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 characteristics, NMOS inverter, propagation delay, NMOS logic gate, CMOS logic gates, BJT inverter, TTL NAND gate, TTL output stage, TTL logic families, ECL circuits, comparison 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.


BOOKS:
3. Gayakwad: Op-Amp & Linear IC’s, 2nd Ed.

Analog & Digital ICs Laboratory
List of Experiments:
1. INV-NON INV Amplifier using IC 741.
2. INTEGRATOR & DIFFERENTIATOR using IC 741.
3. Voltage follower 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 74C76.
13. Verification of Comparator using IC 7485.
14. Verification of BCD to decimal decoder using IC 7442.
15. Verification of decade counter.

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.

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, duality-network transformation.


SECTION-B

Unit-IV: Network theorems:- Superposition theorem-Reciprocity theorem, Thevenin’s theorem-Norton’s theorem-Millman’s theorem-Max. power transfer theorem-Substitution theorem-Compensation theorem, Tellegen’s theorems.

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.

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 function-LC network.
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


SECTION - B


Unit VI: Economics of Development : Meaning, Characteristics 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.

4Sb5 BIOMATERIALS & BIOMECHANICS


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/Implants: 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, Foot 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.
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
8. VC Mow and W C Hayes, Basic Orthopedic Biomechanics, Lippincott,
Raven publishers.

******
ENVIROMENTAL 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.
   - Environmental ethics: Issues and possible solutions.
   - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
   - Wasteland reclamation.
   - Consumerism and waste products.
   - Environment Protection Act.
   - Air (Prevention and Control of Pollution) Act.
   - Water (Prevention and Control of Pollution) Act.
   - Wildlife Protection Act.
   - Forest Conservation Act.
   - Issues involved in enforcement of environmental legislation.
   - 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:
     - 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.
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.
   - Disaster 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:
2) Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013, India, Email: mapin@icenet.net (R)
4) Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
6) De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7) Down to Earth, Centre for Science and Environment (R)
9) Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Mumbai (R)
14) Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co. (TB)
18) Survey of the Environment, The Hindu (M)
23) Dr. Deshpande, A.P.Dr. Chudiwale, A.D., Dr. Joshi, P.P., Dr. Lad, A.B.: Environmental Studies, Pimpalapure & Co., Publishers, Nagpur. (R)
24) Dr. Rajagopal, R: Environmental Studies, Oxford University Press, New Delhi, 2005 (R)

(M) Magazine
(R) Reference
(TB) Textbook
******
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Subject Title</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P/D</td>
</tr>
<tr>
<td>1.</td>
<td>3 SB 1</td>
<td>Transforms &amp; Probability</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>2.</td>
<td>3 SB 2</td>
<td>Human Physiology</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>3 SB 3/3SI4</td>
<td>Transducers &amp; Signal Conditioning</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>3 Suleib</td>
<td>Network Analysis</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>5.</td>
<td>3 SB 5</td>
<td>Bio Physics</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>4SB1/3SR5</td>
<td>Object Oriented Technologies</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>2.</td>
<td>4 SB2/4SR3</td>
<td>Analog &amp; Digital ICs</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>4 Suleib</td>
<td>Network Analysis</td>
<td>4</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>4.</td>
<td>4SRULEINB</td>
<td>Social Sciences and Engineering Economics</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5.</td>
<td>4 SB 5</td>
<td>Biomaterial &amp; Biomechanics</td>
<td>4</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>
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 (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 1st 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 1st and IIInd 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

Vice-Chancellor

Dr. Kamal Singh
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 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
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>no.</td>
<td>Code L</td>
<td>L</td>
<td>Theory</td>
<td>T</td>
<td>Practical</td>
</tr>
<tr>
<td>---------</td>
<td>--------------</td>
<td>--------</td>
<td>--------</td>
<td>---</td>
<td>----------</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hours/ Week</td>
<td>Duration of Papers (Hrs)</td>
<td>Total Marks</td>
<td>Max. Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Hrs)</td>
<td>Papers</td>
<td>College</td>
<td>Theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>5 SB 1</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>5 SB 2</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>3.</td>
<td>5 SB 3</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>5SULB4</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>5.</td>
<td>5 SB 5</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>5 SRNB 6</td>
<td>2</td>
<td>-</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>22</td>
<td>2</td>
<td>8</td>
<td>32</td>
</tr>
</tbody>
</table>

**SEMESTER: SIXTH**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>no.</td>
<td>Code L</td>
<td>L</td>
<td>Theory</td>
<td>T</td>
<td>Practical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hours/ Week</td>
<td>Duration of Papers (Hrs)</td>
<td>Total Marks</td>
<td>Max. Marks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Hrs)</td>
<td>Papers</td>
<td>College</td>
<td>Theory</td>
</tr>
<tr>
<td>1.</td>
<td>6SB1</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>6SB2</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>3.</td>
<td>6SB3</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>4.</td>
<td>6SB4</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>5.</td>
<td>6SB5</td>
<td>4</td>
<td>-</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>6.</td>
<td>6SB6</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td>20</td>
<td>1</td>
<td>6</td>
<td>27</td>
</tr>
</tbody>
</table>

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

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 & sparse 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 VI: Graph theory, sequential representations of graphs, Warshall’s algorithm, Linked representation, operations & traversing the graphs. Po sets & Topological sorting. Insertion Sort, Selection Sort. Merging & Merge-sort, Radix sort, Hashing.

Textbook:

References:
1. Ellis Horowitz, Sarat Sahni - Fundamentals of Data Structures (CBS Publications)
2. Trembley, Sorenson: An Introduction to Data Structures with Applications (TMH)
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.

1. 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, Electro-mechanical systems, physiological systems, block diagram modelling, signal flow graphs.

Unit II: TIME RESPONSE ANALYSIS


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, oculomotor 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

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
- Nerst 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 Plethysmogrophy
- 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:
1) 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/ COMMUNICATIONENGINEERING

5 SUL 4 SECTION-A


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, fidelity communication receiver.

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 bandwidth, 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:
2) Young P.H.: Electronics Communication Techniques, Coloumbus, A Bell and Howell Co. (First Edition)
7) Dhake: TV Engineering.

5 SB 5

PATHOLOGY & MICROBIOLOGY

Unit I: NORMAL CELL STRUCTURE
Cell Degeneration and regeneration - Inflammations, apoptosis, Neoplasia. Classification, Difference between benign and malignant

Etiology of tumors - Spread of Tumors.


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

5 SRN 6 COMMUNICATION 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 effectiveness and subject content. Non-verbal communication, types of graphics and pictorial 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:
2) Chrissie Wright (Editor) : Handbook of Practical Communication Skills, Jaico Publishing House.
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.

TEXTBOOK: Norman Lewis : Word Power Made Easy
http://www.teachingenglish.org.uk

******

SEMESTER: SIXTH

6 SB I DIAGNOSTIC & THERAPEUTIC EQUIPMENTS

DIAGNOSTIC EQUIPMENT

Unit I: Introduction to Biomedical Recorder
ECG recorder, Microprocessor based ECG machines, 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 imaging techniques for X-Rays
Computed Radiography, Computed Tomography
Ultrasonic imaging system, Physics of ultrasound
Basic modes of transmission
Ultrasonic display modes - A-scan, B-scan, M-scan 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 Ultrasound therapy unit
- Therapeutic apparatus
- Surgical diathermy machine
- Electrodes used with surgical diathermy Infant incubators
- Therapeutic application of laser

Text Books:
1) R.S.Khandpur: Handbook of Biomedical Instrumentation, TMH Pub.

Reference Books:
1) Carr & Brown: Introduction to Biomedical Equipment.

6 SIB 2/ 6 SI 2
BASIC INDUSTRIAL MANAGEMENT

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, inventory control, introduction to production, planning and control.

Unit III:
Personnel management:
Meaning and functions of personnel management, recruitment, selection, promotion, wages and salary administration, training and development, functions and scope of trade unions in Indian industries. Welfare of labour, Problems of labour turnover & 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. Entrepreneurial 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:
2) Khanna O.P. : Industrial Engineering and Management.
### 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)roy 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:
1. W. A. Triebel & Avatar Singh: The 8088/8086 Microprocessors (4e) (PHI /Pearson Education)
2. Liu & Gibson: The 8088/8086 Microprocessor (2/e) (PHI)

### REFERENCES:

### 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 +, -, *, / 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 \[ \text{RESULT} = [\text{AL}] \times \text{NUM1} + [\text{NUM2}] \times \text{AL} + \text{BL} \]
- Assume that all parameters are byte- sized. NUM I, NUM2 and RESULT 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 1 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 DX 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 21 H, function 2AH.
  - DH = Month
  - DL = Day of month
  - CX=Year
  - AL=Day of the week
Using DOS INT 21H function 08H write a program in TASM 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 RADIOTHERAPY & IMAGING**


Unit II: Radio-diagnosis
Radiography, Angiography, Fluoroscopy, Image intensifier, Multi section radiography, Instrumentation 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 techniques, basic NMR components, applications, Advantages & disadvantages of NMR, Imaging techniques, Biological effects of NMR 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 therapy, 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.


**TEXT BOOKS:**
1) 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 of modelling 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 viscoelasticity, 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 of linearize model of lungs mechanics, circulator control model and glucose insulin regulation model by MATLAB Tool.

Unit VI: Study of steady state analysis of muscle 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 1 Diagnostic & Therapeutic Equipments and 6 SB 4 Radiological Equipments.

---

******
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 competent 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 University 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 presents 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) 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 :-

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Grade/Category</th>
<th>Marks secured</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>“A”</td>
<td>- 60 and above</td>
</tr>
<tr>
<td>2.</td>
<td>“B”</td>
<td>- 45 to 59</td>
</tr>
<tr>
<td>3.</td>
<td>“C”</td>
<td>- 35 to 44</td>
</tr>
<tr>
<td>4.</td>
<td>“D”</td>
<td>- 25 to 34</td>
</tr>
<tr>
<td>5.</td>
<td>“Fail”</td>
<td>- 24 and below</td>
</tr>
<tr>
<td>6.</td>
<td>“Absent”</td>
<td></td>
</tr>
</tbody>
</table>

12. For the purposes of teaching, learning 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/Chairpersonsip. 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 eligible.

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.

*****