VII & VIII Semester B.E.
(Biomedical Engineering)

Prospectus No. **121713**

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

(FACULTY OF ENGINEERING & TECHNOLOGY)

PROSPECTUS

Prescribed for

Four Year Degree Course

Bachelor of Engineering

Biomedical Engineering

VII & VIII Semester

Examinations, 2011-2012

Semester Pattern

2011

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SYLLABUS
PRESCRIBED FOR
FOUR YEAE B.E. DEGREE COURSE IN
BIOMEDICAL ENGINEERING
SEMESTER PATTERN

SEVENTH & EIGHTH SEMESTER

SEVENTH SEMESTER

7 SB 1 BIO SIGNAL PROCESSING

UNIT I : Discrete-time Signals and Systems:-

Characterization, classification and time-domain representation of discrete-time signals, Typical sequences and their representation, Classification of sequences, Basic operations on sequences, Discrete-time systems.

UNIT II : The discrete-time Fourier transform (DTFT):-

The discrete Fourier Transform (DFT), Computation of the DFT. Theory of Z-Transform Mathematical derivation of the unilateral z-transform, Properties of the z-transform, the inverse z-transform, The bilateral z-transform, Power series, Region of convergence (ROC) and its impedance.

UNIT III : Neurological Signal Processing:-

The brain and its potentials, The electrophysiological origin of brain waves, The EEG signal and its characteristics, EEG analysis, Linear prediction theory, The autoregressive (AR) method, Recursive estimation of AR parameters, Spectral error measure, Adaptive segmentation, Transient detection and elimination – the case of epileptic patients, Overall performance.

UNIT IV : Cardiological Signal Processing:-

Basic electrocardiography, ECG data acquisition, ECG lead system, ECG parameters and their estimation, the use of multi-scale analysis for parameters estimation of ECG waveforms, Arrhythmia analysis monitoring, Long-term continuous ECG is recording.

UNIT V : ECG Data Reduction Techniques:-

Direct data compression techniques, Direct ECG data compression techniques, Transformation compression technique, other data compression techniques, The PRD index.

UNIT VI : Data compression techniques:-

ECG acquisition and transmission. Data reduction algorithms. Turning point. AZTEC, CORTES and the KL transform.

Text Books:-

1. Biomedical Signal Processing, Principles and Techniques by D.C. Reddy, Tata McGraw Hill, 2005.
2. Biomedical signal processing. Vol-I, Time frequency analysis. Cohen A. CRC press.
3. Biomedical signal processing. Akay M. Academic Press.D.C.Reddy, "Biomedical Signal Processing – Principles and Techniques", TMH.
4. Wills J. Tompkins, "Biomedical digital signal processing", Prentice Hall of India Pvt. Ltd.
5. Digital biosignal processing. Weitkunat R, Elsevier.

Biomedical Signal Processing Lab:-

1. Sine wave generation using C.
2. Designing an FIR filter using MATLAB and DSP Kit.
3. Designing an IIR filter using MATLAB and DSP Kit.
4. Fourier analysis of periodic signal.
5. Time frequency domain properties of different windows using MATLAB.
6. Implementation of the Double-Precision Complex FFT for ECG signal.
7. Design of Notch filter for elimination of 50Hz from ECG signal.
8. EMG processing using MATLAB –Rectification and Signal Averaging.

7 SB 2 ARTIFICIAL ORGANS & REHABILITATION ENGINEERING

UNIT I : Introduction to artificial organs: Biomaterials used in artificial organs and prostheses, inflammation, rejection, correction.Rheological properties of blood, blood viscosity variation: effect of shear rate, hematocrit, and temperature and protein contents. Casson equation, flow properties of blood through the blood vessels, problems associated with extracorporeal blood low**:**Substitutive medicine, outlook for organ replacement, design consideration, evaluation process.

UNIT II : Audiometry: air conduction, bone conduction, masking, functional diagram of an audiometer. Hearing aids: different types,receiver amplifiers. Opthalmoscope, retinoscope, I.A.B.P principle and application.

Rehabilitation Engineering: Impairments, disabilities and handicaps, Measurement and assessment. Characterizing engineering concepts in sensory and motor rehabilitation. Engineering concept in communication disorders. Rehabs for locomotion, visual, speech & hearing. Artificial limb and hands.

UNIT III : ARTIFICIAL HEART AND CIRCULATORY ASSIST DEVICES: Engineering design, Engg design of artificial heart and circulatory assist devices, blood interfacing implants – introduction, total artificial hearts & ventricular assist devices, vascular prostheses, Non-blood interfacing implants for soft tissues- sutures and allied augmentation devices, percutaneous and skin implants, maxillofacial implants, eye and ear implants.

UNIT IV : CARDIAC VALVE PROSTHESES: Mechanical valves, tissue valves, current types of prostheses, tissue versus mechanical, engineering concerns and hemodynamic assessment of prosthetic heart valves, implications for thrombus deposition, durability, current trends in valve design, vascular grafts-history, synthetic grafts, regional patency, thrombosis, neointimal hyperplasia, graft infections.

UNIT V : ARTIFICIAL KIDNEY: Functions of the kidneys, kidney disease, renal failure, renal transplantation, artificial kidney, dialyzers, membranes for haemodialysis, haemodialysis machine, peritoneal dialysis equipment-therapy format, fluid and solute removal.

ARTIFICIAL BLOOD: Artificial oxygen carriers, flurocarbons, hemoglobin for oxygen carrying plasma expanders, hemoglobin based artificial blood.

UNIT VI : ARTIFICIAL LUNGS: liver Gas exchange systems, Cardiopulmonary bypass (heart-lung machine)-principle, block diagram and working, artificial lung versus natural lung. Liver functions, hepatic failure, liver support systems, general replacement of functions.

ARTIFICIAL PANCREAS: Structure and functions of pancreas, endocrine pancreas and insulin secretion, diabetes, insulin, insulin therapy, insulin administration systems. Tracheal replacement devices, laryngeal replacement devices, Artificial esophagus Artificial Skin: Vital functions of skin, current treatment of massive skin loss, design principles for permanent skin replacement.

Text Books:

1. Biomedical Engineering Handbook-Volume 1, 2nd Edition - by J.D.Bronzino, CRC
2. Biomedical Engineering Handbook-Volume 2 (2nd Edition) - by J.D.Bronzino, CRC
3. Hand book of Biomedical Engineering. Bronzino. Joseph
4. Hand book of Biomedical Instrumentation. R.S.Khandpur
5. Artificial Organs. Erie.D.Blom, Howard.B.Rotham.

6. Biomedical Engineering Principles (Volume – II). David O. Cooney., Marcel Dekker Inc.

7 SB 3 NETWORKING AND INFORMATION SYSTEM IN MEDICINE

UNIT I : Networking technology:-WAN/LAN, T1, ISDN, DSL, Internet (http, url, domains), ISO model, Ethernet, TCP/IP, Packet switching, circuit switching, Throughput, bandwidth, level of service parameters

UNIT II : Basic Security Concepts System security in general, Authentication, Authorization, Confidentiality, Integrity

UNIT III : Radiology Imaging basics:-Principles of different modalities (CR, DR, XR, XA, RF, US, MR, NM, CT), Image characteristics for each modality Workflow Steps in Radiology and Planning, Designing and Implementing film less Hospital.

UNIT IV : Introduction to RIS and PACS and HIS/RIS/PACS integration Reengineering workflow: Focus on personnel and process Interoperability and Workflow integration issues

UNIT V : Reengineering workflow: Radiologist's Perspective Image acquisition and compression. PACS Architecture Networking and Security

UNIT VI : Server and operating system Storage and Enterprise Archiving Image Displays Tele-radiology Legal Issues and formal policies

Laboratry work:

8 minimum Practicals from above syllabus

Text Books:

1. PACS Guide to Digital Revolution by Keith J. Dreyer (Springer)
2. Governance of Picture Archiving and Communications Systems by Carrison K.S. Tong (Medical Information Science Reference)
3. PACS and Imaging Informatics by H.K. Huang, John Wiley
4. Data Communication and Networking by Behrouz A. Forouzan McGrow Hill

Reference Books:

1. Computer Networks by A.S. Tanenbaum, Pearson Education
2. Practical_Imaging_Informatics.pdf
3. PACS fundamentals- By Herman Oosterwijk
4. DICOM Standard (http://www.dclunie.com/dicom-status/status.html)

7 SB 4 HOSPITAL ENGINEERING & MANAGEMENT

UNIT I : Classification of hospital & architecture:

General hospital, specialized hospital, primary health care – their role and functions. Aspects of hospital services – inpatient, outpatient and mergency. Location and environment of hospital.

UNIT II : Hierarchy of medical and paramedical staff & their functions and responsibilities:-

Modern Hospital Architecture- space in a hospital building, design of ward, intensive care units, air conditioning, plumbing & sanitation, gas supply, waste disposal, cleaning, dietary, sterilizing, laundry, storage and operation theatre systems, Radiology, Central labs, Blood banks, OPD, Causality, etc.

UNIT III : Electrical power systems in hospitals:

Safety of electrical systems, Protective systems - interference of patient's protection grounding. Design of sub stations, breakers, Surge protectors, EMI filters, voltage stabilizers, generator sets and UPS. Uninterrupted power supply for ICU and computerized monitoring units. Specification & estimation for hospital wiring.

UNIT IV : Air conditioning & gas supply systems:

Air conditioning and refrigeration systems for small and large areas. Air changes, filtering and sterility. Deodorizations, disinfection, Dehumidification and cryogenic systems. Centralized supply of air, oxygen, nitrous oxide & vacuum - Principle of production of liquid oxygen. Management lifts fire fighting equipments.

UNIT V : Hospital engineering & Management:

Definition of biomedical Engineering, clinical engineering & hospital engineering. Importance of BME department – servicing and maintenance, testing, acceptance & maintenance protocols, Computerized preventive maintenance planning, MROs. Training of men for medical equipments preventive and periodical maintenance procedures. Preparation of estimates, specifications, tender details etc. Importance of ISO 9000 Certificates - Obtaining ISO certificates in hospitals. Proposed protocols.

UNIT VI : Hospital Information system: Role of database in HIS. Need of Networking in HIS. Overview of Networking, topologies and its configuration. Structuring medical records to carry out functions like admissions, discharges, treatment history etc. Computerization in pharmacy & billing. Automated

clinical laboratory systems & radiology information system.

Laboratory Work:-

Minimum 8 Case Study based on above syllabus to be conducted in Hospitals

Reference Books:

1. Harold E. Smalley, "Hospital Management Engineering – A guide to the improvement of hospital management system", PHI.
2. C. A. Caceras ,"Clinical Engineering"
3. L. C. Redstone ,"Hospital and Health Care Facilities" Ward ,"Anesthetic Equipments". IS, "ISO Certification details"
4. Bhaumick and Bhattachary," EHV Substation equipments"
5. Alexander Kusko," Emergency and Standby Power Systems"
6. Balagune Swamy ,"Reliability Engineering"
7. Anantha Narayanan ,"Basic Refrigeration and Air Conditioning"

7 SB 5 ELECTIVE-I

1) Tissue Engineering

UNIT I : Introduction:

Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

UNIT II : Cell culture:

Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspect of cell culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

UNIT III : Molecular biology aspects:

Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

UNIT IV : Scaffold and transplant:

Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation.

UNIT V : Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology stems cells: introduction, hepatopoiesis.

UNIT VI : Case study and regulatory issues:

Case study of multiple approaches: cell transplantation for

liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

Text / Reference Books:

1. Principles of tissue engineering, Robert. P.Lanza, Robert Langer & William L..
2. The Biomedical Engineering –Handbook, Joseph D. Bronzino,
3. Introduction to Biomedical Engg. , Endarle, Blanchard & Bronzino, Academic
4. Tissue Engineering, B. Palsson, J.A. Hubbell, R.Plonsey & J.D. Bronzino

7 SB 5 **ELECTIVE-I**

2) Bio-Informatics

UNIT I : **Introduction to genomics**:

Information flow in biology, DNA sequence data, experimental approach to genome sequence data genome information resources.

UNIT II : **Functional proteomics**:

Protein sequence and structural data, protein information resources and secondary data bases. NBFR-PIR, SWISSPROT

UNIT III : **Introduction to Genomic data and Data Organization**:

Sequence Data Banks – Introduction to sequence date banks –, Signal peptide data bank, Nucleic acid sequence data bank –GenBank, EMBL nucleotide sequence data bank, and AIDS virus sequence data bank. RRNA data bank, structural data Bank

UNIT IV : **Computation genomics**:

Internet basics, biological data analysis and application, sequence and data bases, NCBI model, file format, Perl programming, bioperl, introduction and overview of human genomic project.

UNIT V : **Sequence alignment and data base search**:

Protein primary sequence analysis, DNA sequence analysis, pair wise sequence alignment, FASTA algorithm, BLAST, multiple sequence alignment, DATA base searching using BLAST and FASTA.

UNIT VI : **Structural data bases**:

Small molecules data bases, protein information resources, protein data bank, genebank, swissport, enterz..

Text / Reference books:

1. Introduction to bioinformatics, Atwood, Pearson education.
2. Introduction to bioinformatics, Arther M.Lesk-OUP
3. Bioinformatics sequences and genome analysis, David W.Mount, 2nd. Edn. CBS publishers.
4. Introduction to bioinformatics computer skills, Cynthia Gibas and Per Jambeck, 2001 SPD.

EIGHTH SEMESTER

8 SB 1 **PROFESSIONAL ETHICS AND VALUES**

UNIT I : Science, Technology and Engineering as knowledge and as Social and Professional Activities Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome.

UNIT II : **Limits of growth**: sustainable development. Energy Crisis: Renewable Energy Resources. Environmental degradation and pollution. Eco-friendly Technologies. Environmental Regulations, Environmental Ethics. Appropriate Technology Movement of Schumacher; later developments. Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation. Human centered Technology.

UNIT III : **Ethics of Profession**:

Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.

UNIT IV : **Profession and Human Values**:

Values Crisis in contemporary society. Nature of values: Value Spectrum of a good life.

UNIT V : **Psychological values**:

Integrated personality; mental health. Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity.

UNIT VI : **Moral and ethical values**:

Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility.

Reference Books:

1. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New York 1994 (2nd Ed)
2. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 1991.
3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 1996.

8 SB 2 BIO MEDICAL IMAGING SYSTEM

UNIT I : **Digital image fundamentals:** Image digitization, sampling and quantization, neighbour of pixels, connectivity, relations, equivalence and transitive closure, distance measures, arithmetic / logic operations, discrete transform, fast Fourier transform,2-D Fourier transform, inverse Fourier transform.

UNIT II : **Image enhancement fundamentals**: Spatial domain method, frequency domain method, contrast enhancement, histogram processing, image smoothing, image averaging, asking, image sharpening, removing of blur caused by uniform linear motion, enhancement in the frequency domain – low pass, high pass, mean and band-pass filtering.

UNIT III : **Image restoration fundamentals:** Degradation model, discrete formulation, algebraic approach to restoration – unconstrained & constrained.

UNIT IV : **Image compression and segmentation fundamentals**: Fidelity criteria, image compression models, loss and lossless compression technique.

UNIT V : **Image segmentation:** point detection, line detection, edge detection, edge linking and boundary detection.

UNIT VI : **Algorithms used in medical image processing:** Brief of reconstruction techniques – algebraic, simultaneous iterative and simultaneous algebraic. Reconstruction algorithm for parallel projections, fan beam projection and back projection. Introduction to various approaches of pattern recognition.

Text books:

1. Digital image processing by Gonzalez and Woods, 2nd ed., Pearson
2. Digital image processing and analysis by Chanda & Majumdar, PHI
3. Fundamental of digital image processing by Jain, PHI
4. Pattern recognition by Tou and Gonzalez

Medical Image Processing Lab

[Students are required to perform at least SIX experiments]

1. Maximum distance algorithm

2. Image enhancement – Histogram
3. Image smoothing
4. Image sharpening
5. Algorithm for low pass filter, high pass filter, median filter
6. Point detection
7. Line detection
8. Edge detection

8 SB 3 ELECTIVE-II

1) Nuclear Medicine

UNIT I : Basics of Nuclear Physics: Radioactivity, Radioactive Decay Law, Units of Radioactivity Measurement, Interaction of Radiation with Matter

UNIT II : Detectors in Nuclear Medicine: Scintillation Detectors, and Solid State detectors. Basic Instrumentation in NM: Co incidence and Anti coincidence circuits, Single and Multi Channel Pulse Height Analyzers, Gamma Ray Spectrometry.

UNIT III : In Vivo Techniques: General Principle, Radiopharmaceuticals. selection and localization, Uptake Monitoring system, Rectilinear Scanner, Gamma Camera Fundamentals, Position Circuitry and working, Computer Interface, Performance Parameters, Quality Control Functions

UNIT IV : Emission Tomography Techniques: Introduction, Principles and applications of SPECT, Principles and applications of PET, System performance parameters and Quality Control Functions

UNIT V : In Vitro techniques(Brief Description): Introduction, Single and Double Isotope method, Radioimmunoassay, RIA Counting System, Liquid scintillation Counting system, RIA Applications.

UNIT VI : Radiation Safety: External radiation Hazards & prevention, Internal radiation Exposure, Biological effects of radiation exposure, Disposal of Biological waste.

Text Books:

1. Textbook of Nuclear medicine: A.F.G. Rocha
2. Handbook of Nuclear medicine Instruments: Bairi, Singh, Rathod, Narurkar

References Books:

1. Medical Radiation physics: William Hendey
2. Instrumentation of Nuclear medicine: G. Hine.

8 SB 3 ELECTIVE-II

2) ADVANCED MEDICAL EQUIPMENTS

UNIT I : **Hospital power distribution system:** Design and layout, power factor improvement, maximum demand, safety, metering, booster transformers, isolators. Electrical Safety: physiological affects of electricity, macro-shock and micro-shock hazards, electrical safety codes and standards, electrical safety analyzers, testing the electric systems.

UNIT II : **Electrosurgical Equipment:** ESU, principles of cutting and coagulation, spark gap, valve and solid state generators, safety features. Introduction to Lithotripsy-Principles and Applications, Physiotherapy Equipment-Short Wave, Microwave and Ultrasound Diathermy, Ophthalmic Instruments-Intraocular Pressure measurement Contacting and Non-Contacting Types, Refractometer, Ophthalmoscope, Retinoscope, Keratometer.

UNIT III : **Audiometry**: Common tests and procedures, audiometer. Hearing Aids: Different types, comparison of microphones receivers and amplifiers, cochlear Implants. Neonatal instrumentation: incubators, aproea monitor, photo-therapy devices.

UNIT IV : **Haemodialyzer**: qualitative requirements, general scheme of operation, types of exchangers, block diagram, electronic control and monitoring. General anesthesia: information about medical gases and vacuum systems, anesthesia equipments Liquid medical –O2 systems, Theatre sterility practices.

UNIT V : **Imaging Equipment:** Ultrasound, computer aided tomography, magnetic resonance imaging, SPECT, PET: Basic Principle of Operation and Applications. Introduction to Radionuclide Instrumentation-Gamma camera, rectilinear scanner, radioisotopes, mobile C-ARM radiotherapy equipment fMRI.

UNIT VI : **Photonics:** Optic fibers: optical fiber waveguides, wave propagation, types of optical fibers, attenuation and dispersion in optical fibers, applications in Endoscopy.

Lasers: Emission and Absorption in Radiation, Population Inversion and Threshold condition, Laser Losses, Types of Lasers-CO2, Helium-neon, Nd-Y-Ag lasers, Applications in Surgery, Angiography, and Endoscopy.

Suggested reading:

1. Bronzino Joseph D., *Handbook of Biomedical Engineering*, CRC Press, 1995.

2. Khandpur R.S., *Handbook of Biomedical Instrumentation*, Tata McGraw Hill, 1994.
3. John G.Webster, *Medical Instrumentation: Application and Design*, Jhon Wiley and Sons Inc., 3rd Ed., 2003.
4. Cotton H., *Electrical Technology*, AHW & Co., 1983.

8 SB 4 BIO MEDICAL EMBEDDED SYSTEM DESIGN

UNIT I : **MCS 51 Microcontroller family**

Introduction to MCS family, Comparison of microprocessor and microcontroller, Features, Architecture, functional pin description, SFRs, various resources of MCS-51 Hardware Review: Study of Port structure, Interrupt structure, Timer/ Counter, Serial port.

UNIT II : **8051 Assembly Language Programming**

Addressing modes, Instruction set, Assembly Language Programming, CPU timings, 8051A as a Boolean Processor, Power Saving Options, 8051 I/O expansion using 8255, Typical MCS51 based system, Multiprocessor Communication in MCS-51, interfacing problems

UNIT III : **Embedded Systems:**

Basic concepts, requirements, categories, design challenges Embedded operating system –Types , Hardware architecture, Software architecture, application software, communication software, process of generating executable image, development/testing tools

UNIT IV : **Embedded System Development**

The development process, requirements engineering, design, implementation, integration and testing, packaging, configuration management, management of development projects

UNIT V : **The execution environment**

memory organization, system space, code space, data space, unpopulated memory space, i/o space, system start up, interrupt response cycle, Functions Calls & Stack Frames, run time environment.

UNIT VI : **Architecture of Kernel, Tasks and Task Scheduler -** Task States, Content Switching, Scheduling Algorithms, Rate Monotonic Analysis, Task management Function Calls. Interrupt Service Routines, Semaphores, mutex, mailboxes, message queues, event registers, pipes, signals, timers, memory management, Priority Inversion Problem Design methodologies and design flows, case studies- fetal heart rate monitor, versatile drop foot stimulator, myoelectric arm, telemonitoring system

Term work:

Minimum 10 experiments on MCS 51

List of Experiments

1. Interfacing with 8085 microprocessor and 8051 microcontroller
   a) Traffic light controller
   b) 7-segment display
   c) Analog to Digital Converter
   d) Matrix keyboard
   e) LCD display
   f) Digital to Analog Converter
   g) Stepper motor
   h) DC- motor
2. Interfacing of matrix sensors to PIC microcontroller
   a) Heart rate monitor
   b) ECG sensor
   c) Carbon dioxide and oxygen sensors
   d) Ion selective sensors
   e) Analog interfacing of rabbit core modules
   f) OP 7200 LCD display controller

Text Books:

1. The 8051 microcontrollers-Kenneth J Ayala
2. Rajkamal, Embedded systems-architecture, programming and design, Tata McGraw Hill
3. Frank Vahid,Toney Givargi-Embedded System Design: A unified Hardware /Software Introduction John Wiley publication
4. David E. Simon -An Embedded Software Primer Pearson Education

Reference Books:

1. Muhammad A Mazidi, The 8051 Microcontroller and Embedded Systems, Pearson Education
2. Sriram Iyer and Pankaj Gupta, Embedded Real-time systems programming, Tata McGraw Hill
3. Embedded Microcomputer Systems- Real time Interfacing –Valvano
4. Arnold S. Berger, *An introduction to Processes, Tools and Techniques*, CMP books, 2005.
5. Dr.K.V.K.K.Prasad, *Embedded Real time Systems*, Dreamtech Press, 2003.
6. Wayne wolf , "Computers as Components: Principles of Embedded Computer systems design", Morgan Kaufmann Publishers,2000

8 SB 5 PROJECT AND SEMINAR

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DIRECTION

No.29/2011 Date : /06/2011

Subject : Schemes of teaching & examinations of VII & VIII 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 (अभियांत्रिकी स्नातक) 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 VII & VIII Semesters of Bachelor of Engineering (Biomedical Engineering) were accepted and recommended by the Faculty of Engineering & Technology vide Item No. 39 L) R-1) in its meeting held on 06-06-2011,

AND

Whereas the schemes of teaching & examinations of VII & VIII Semesters of Bachelor of Engineering (Biomedical Engineering) were accepted by the Hon'ble Vice-Chancellor u/s Section 14 (7) of M.U. Act, 1994 on behalf on Academic Council on 9th June, 2011,

AND

Whereas the schemes of teaching & examinations of VII & VIII 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 VII & VIII Semesters B.E. (Biomedical Engineering) course are to be implemented from the academic session 2011-2012,

AND

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

Now, therefore, I, Dr.Mohan K. Khedkar, 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, 2011"
2) This Direction shall come into force from the date of its issuance.
3) Schemes of teaching & examinations for VII & VIII 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. Mohan K. Khedkar
Vice-Chancellor

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