SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV YEAR

(BIO-MEDICAL ENGINEERING)

SEMESTER-I

S.NO.	SYLLABUS / REF. NO.	SUBJECT	SCHEME OF INSTRUCTION		SCHEME OF EXAMINATION			CREDITS
			PERIODS PER WEEK		DURATION IN HOURS	MAXIMUM MARKS		
		THEORY	L/T	D/P		UNIV. EXAM	SESSIONALS	
1.	BM401 UE	BIOMEDICAL EQUIPMENT II	4	-	3	75	25	4
2.	BM402 UE	MEDI EMBEDDED SYSTEMS AND RTOS	4	-	3	75	25	4
3.	BM403 UE	MEDICAL IMAGE PROCESSING	4	-	3	75	25	4
4.	BM404 UE	BIOMEDICAL SIGNAL PROCESSING	4	-	3	75	25	4
5.	BM 405 UE	BIOMECHANICS	4	-	3	75	25	4
6.		ELECTIVE II	4	-	3	75	25	4
PRACTICAL								
1.	BM431 UE	MEDI EMBEDDED SYSTEMS LAB	-	3	3	50	25	2
2.	BM432 UE	BMSP AND IMAGE PROCESSING LAB						
3.	BM433 UE	PROJECT SEMINAR	-	3	-	-	25	2
		TOTAL	**24**	**6**		**500**	**200**	**28**

ELECTIVE II:

BM	406UE	Rehabilitation Engineering
CS	408UE	Database Management Systems
EC	423UE	VLSI Technology
EE	405UE	Optimization Techniques
ME	409UE	Entrepreneurship
CE	412UE	Finite Element Analysis
BM	407 UE	Medical Optics

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV YEAR

(BIO-MEDICAL ENGINEERING)

SERVICE COURSES OFFERED TO OTHER DEPARTMENTS

Semester-I

S.No.	Syllabus / Ref. No.	SUBJECT	Scheme of Instruction		Scheme of Examination		
			Periods per week		Duration in Hours	Maximum Marks	
(Elective – II)		**THEORY**	L/T	D/P		Univ. Exam	Sessionals
1	BM406 UE(CE/CSE/ECE/EEE/ME)	Medical Instrumentation	4	-	3	75	25
2	BM 405 UE (ME/EEE/ECE)	Biomechanics					
TOTAL			**4**	**-**	**3**	**75**	**25**

BM 401 UE

BIO-MEDICAL EQUIPMENT-II

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

OBJECTIVES:
> a. To familiarize the latest technologies of modern medicine
> b. To make learners able to use new and updated diagnostic methodologies
> c. To make learners capable enough of adopting the methods of recovery and

Improving health with a service approach

UNIT I
Hospital power distribution system: Design and layout, power factor improvement, maximum demand, safety, metering, booster transformers, isolators. Electrical Safety: physiological effects 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.
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 euipment Liquid medical $-O_2$ systems, Theatre sterility practices.

UNIT IV
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 V
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.

MEDI EMBEDDED SYSTEMS AND RTOS

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination   75 Marks
Sessional: 25 Marks
Credits   4

OBJECTIVES:
a.   Able to write programs to interface with 8085/8086
b.   Able to write programs to interface with 8051
c.   Know the concept of interfacing PIC microcontroller.

UNIT I
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 II
Embedded System Development --The development process, requirements engineering, design, implementation, integration and testing, packaging, configuration management, management of development projects. 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 III
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

UNIT IV
Interfacing with 8051 and ARM- Biomedical sensors, ADC, DAC, Seven Segment display, stepper motor, traffic control, , LCD &Keypad Controllers for biomedical applications,
Biomedical Applications of Bluetooth Protocol using Radio Technology, Ethernet-Use of Internet Protocols.

UNIT V
Design methodologies and design flows, case studies- fetal heart rate monitor, versatile drop foot stimulator, myoelectric arm, telemonitoring system

Suggested Reading:
1. Arnold S. Berger, *An introduction to Processes, Tools and Techniques*, CMP books, 2005.
2. Dr.K.V.K.K.Prasad*, Embedded Real time Systems*, Dreamtech Press, 2003.
3. Wayne wolf , "Computers as Components: Principles of Embedded Computer systems design", Morgan Kaufmann Publishers,2000

MEDICAL IMAGE PROCESSING

Instruction :	4 Periods
Duration of university examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

UNIT-I: FUNDAMENTALS
Digital image, Elements of digital geometry, Components of DIP, Visual detail.
Visual preliminaries- Brightness adaptation and Contrast, Acuity and contour, Texture and pattern discrimination, Shape detection and recognition, Perception of color. Image formation- Geometric Model and Photometric Model, medical applications

UNIT-II: IMAGE ENHANCEMENT
Spatial Domain Methods –Binary Image, Negative of an Image, Log Transformations, Power law Transformation, contrast enhancement, Histogram equalization, Spatial Domain Filters-Smoothing filters, Sharpening filters.
Frequency Domain Methods- Steps for filtering in the frequency domain, Convolution theorem, Smoothing filters, Sharpening filters, Homomorphic filtering. Medical applications

UNIT-III: IMAGE RESTORATION
A model of the image degradation, noise models, restoration in the presence of noise-spatial filtering, periodic noise reduction by frequency domain filtering, linear & position-invariant degradations, estimating the degradation function, inverse filtering, wiener filtering, constrained least squares filtering, geometric mean filter, medical applications

UNIT-IV: SEGMENTAION
Points detection, line detection, edge detection methods, Histogram based image segmentation, segmentation using split and merge method, region growing method, watershed method, k-means clustering method, self-similar fractal method, comparison of all the methods, medical applications.

UNIT-V: REPRESENTAION, DESCRIPTION AND RECOGNITION
Representation, boundary descriptors, regional descriptors, principal component analysis, relational descriptors. Recognition based on decision-theoretic and structural methods, medical applications.

Suggested Reading :
1 R.C Gonzalez and R.E. Woods, Digital Image Processing, 2nd Ed, Prentice Hall. 2002.
2 Anil K. Jain, Fundamentals of Image Processing, Prentice Hall, Englewood clifs, New Jersey,1989
3.G.R.Sinha and BhagavathiCharan Patel, Medical Image Processing concepts and applications,PHI,2014
4.Chanda&Majumdar, Digital image processing and analysis, Second edition PHI, 2013.

BM 404 UE

BIOMEDICAL SIGNAL PROCESSING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	4

OBJECTIVES:
a. Understand the need for adaptive filters
b. Understand the signal processing techniques used for ECG and EEG
c. Understand the signal processing steps involved in Brain-Computer Interface
d. Understand the wavelet concepts

UNIT I
Time domain and frequency domain filters, Adaptive filters, Weiner filter principles, Selection of appropriate filter, Optimization algorithms- LMS & RLS, Application of Adaptive Noise Cancellation to ECG monitoring - Cancellation of power line interference, Electrosurgical interference and donor heart interference. Fetal ECG monitoring.

UNIT II
Cardiological Signal Processing: ECG acquisition and transmission.QRS detection methods-Differentiation-based and template-based. Rhythm analysis and Arrhythmia detection algorithms. Automated ECG analysis. Data compression techniques: Data reduction algorithms- Lossy and Lossless types, Turning Point algorithm, AZTEC, CORTES, and the KL transform.

UNIT III
Neurological signal processing: Stochastic process. Linear prediction. Yule-Walker equations. Auto Regressive Modeling of EEG signal. Detection of EEG Rhythms, Template matching for EEG spike-and-wave detection, Detection of EEG spike-and-wave complexes, Coherence analysis of EEG channels, Adaptive segmentation of EEG signals. Sleep stage analysis using Markov model. Analysis of evoked potential using Prony's method.

UNIT IV
Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs. Typical applications.

UNIT V
Wavelets in Medicine: Need for wavelets, Types of wavelets, Selection of a wavelet for an application, Decomposition and reconstruction of signals using wavelets, Denoising using wavelets, Typical medical applications.

Suggested Reading :
1. Rangaraj M. Rangayyan,*"Biomedical Signal Analysis: A Case-Study Approach"*, John Wiley & Sons, 2005.
2. Willis J.Tompkins, *"Biomedical Digital Signal Processing"*, Prentice-Hall of India Pvt. Ltd.,2012.
3. Monson H.Hayes, *"Statistical Digital Signal Processing and Modeling"*, Wiley-India, 2009.
4. Jonathan Wolpaw and Elizabeth Winter Wolpaw, *"Brain-Computer Interfaces: Principles and Practice"*, Oxford University Press, 2012.
5. StephaneMallat, *"Wavelet Tour of Signal Processing*:*The Sparse Way "*, 3rd ed. Academic Press, 2008.

BM 405UE

BIOMECHANICS

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessionals	25 Marks
Credits	4

UNIT-I
Properties of biological tissues: Mechanical Properties of collagen, elastin, bone, cartilage, tendons, ligaments, muscles and synovial fluid. Muscle models. Evaluation tests for mechanical properties of biological tissues. Features of viscoelasticity, constitutive equations and uses of viscoelastic models. Bio-viscoelestic solids and fluids.

UNIT-II
Statics in biomechanics: Analysis of rigid bodies in equilibrium, conditions for equilibrium, free body diagrams, General procedure to analyze systems in equilibrium, Types of support or joint with biomechanical examples. Analysis of joints in various postures. Basic assumptions and limitations, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle.

UNIT-III
Cardiovascular mechanics: Forces involved in blood flow, Generalized Bernoulli's equation, Wind kessel model, Stresses in the ventricular wall, Pressure-Volume loop. Hagen-Poiseuille Law-derivation and applications, steady laminar flow in elastic tube, Wave propagation in blood vessels, Reflection and transmission of waves at arterial junctions, Blood flow in veins, microcirculation.

UNIT-IV:
Pulmonary mechanics: Mechanism of air flow, Respiratory cycle, Lung Ventilation model, Methods of determining pressure, flow-rate and volume-Spirometry, Respiratory plethysmography, Diagnostic significance of the lung-ventilation model, static and dynamic respiratory mechanics tests.

UNIT-V:
Orthopedic implants: Design process of an orthopedic implant, typical specifications for an prosthetic joint, Biocompatibility, Requirements of a biomaterial, Characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants-Mechanical fixation, cements and adhesives, porous materials.

Suggested Reading:
1. Y.C.Fung., *Biomechanics-Mechanical Properties of Living Tissues*, Springer-Verlag,1981.
2. NihatOzkaya and MatgaretaNordin, "*Fundamentals of Biomechanics-Equilibrium, Motion and Deformation*", Sringer-Verlag, 1984
3. Y.C.Fung., *Biodynamics-circulation*, Springer-Verlag,1984.
4. John G. Webster, *Medical Instrumentation-Application and design*, John Wiley and sons Inc., 3rd Ed., 2003
5. D.Dowson and V. Wright, "*AN Introduction to Biomechanics of Joints and Joint Replacements*", Mechanical Engineering Publications, 1980

BM 406 UE

REHABILITATION ENGINEERING

Instruction:	4 Periods per weeks
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

OBJECTIVES:

a. To extend knowledge of the amputee, of lost and remaining functions affecting locomotion, and to collect information on the best possible medical treatment.
b. To improve fitting techniques and practices, including training, so that existing devices might be used with greater comfort and function.
c. To develop improved lower-extremity devices.

UNIT – I
Anthropometry: Methods for Static and dynamic Measurements, Measurement of characteristics and movement, Measurement of Muscular Strength and Capabilities. Engineering Concepts in Sensory Rehabilitation, Motor Rehabilitation, Communication Disorders, Computer-Aided Engineering in customized component design. Intelligent prosthetic knee, Hierarchically controlled prosthetic hand, Self-aligning orthotic knee joint.

UNIT-II
Ergonomic aspects in designating devices: Introduction to Models in Process Control, Design of Information Devices,WheeledMobility:Categories of Wheelchairs. Wheelchair Structure and Component Design. Ergonomics of Wheel chair propulsion. Power Wheelchair Electrical Systems. Control. Personal Transportation. Auxiliary devices and systems.

UNIT – III
Sensory augmentation and substitution: Visual system: Visual augmentation. Tactual vision substitution, Auditory vision substitution; Auditory system: Auditory augmentation. Cochlear implantation, Visual auditory substitution, Tactual auditory substitution, Tactual system: Tactual augmentation. Tactual substitution. Measurement tools and processes: fundamental principles, structure, function; performance and behavior. Subjective and objective measurement methods. Decision-Making process: Current Limitations: Quality of measurements, Standards. Rehabilitation service delivery.

UNIT –IV
ARTIFICIAL LARYNX (pneumatic & electronic): Analyzing artificial electronic larynx, Augmentative Communication, Control and Computer Access. AAC: user interface; outputs, acceleration techniques, Intervention and other issues. Orthopedic Prosthetics and Orthotics: FES systems-Restoration of hand function, restoration of standing and walking. Hybrid Assistive Systems (HAS). Active Above Knee Prostheses. Myoelectric hand and arm prostheses.

UNIT – V
Computer applications in Rehabilitation Engineering: Interfaces in Compensation for visual perception. Improvement of orientation and mobility. Computer-assisted lip reading. Brain-computer interfaces.

Suggested Reading:

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

CS 408 UE

DATA BASE MANAGEMENT SYSTEMS

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

OBJECTIVES:
a. Knowledge of DBMS, both in terms of use and implementation/design
b. Experience with SQL
c. Increased proficiency with the programming language C++
d. Experience working as part of team\
e. Experience with analysis and design of (DB) software

UNIT I
Introduction: database System Applications, Database Systems Versus File Systems, Views of data, Data Models, Database Languages, Database Users, Database Administrators, Transaction Management, Database System Structure, Application architectures. Entity-Relationship Model: Basic concepts, Constraints, Keys, design issues E-R Diagrams, Weak entity Sets, Extended E-R diagrams, Design of an E-R database schema, Reduction of E-R schema to tables, the Unified Modeling Languages.

UNIT II
Relational Model: Structure of related databases, Relational Algebra, Extended Relational Algebra Operators, Extended relational algebra operations, Modification of the database, Views, the Tuple relational calculus, The Domain relational calculus. Structured Query Languages: Basic Structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Complex Queries, Modification of the database, Joined relations, Data-definition languages, Embedded SQL, Dynamic SQL.

UNIT III
Integrity Constraints: Domain Constraints, Referential integrity, Assertion, Triggers, Security, Authorization, Authorization in SQL, Encryption, Authentication. Relational Database Design: First Norma; Form, Pitfalls in Relational database design, Functional Dependencies, Decomposition, Desirable properties of Decomposition, Second Normal Form, Boyce-Codd Normal Form, third Normal Form.

UNIT IV
Indexing and Hashing: Basic Concepts, Ordered indices, B+ Tree index files, B-Tree index files, Hashing, Dynamic Hashing, comparison of ordered and Hashing, Index definition in SQL, Multiple-Key Access.
Transactions: Transaction concept, Transaction state, implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Implementation of isolation, transaction definition in SQL, Testing for serializability.

UNIT V
Concurrency Control: Lock-based protocols, Timestamp-based protocols, Validation-based protocols, multiple granularity, Multiversion schemes, Deadlock handling, Insert and delete operations, Weak Level of Consistency, Concurrency in index structures. Recovery System: Failure classification, Storage structure, recovery and atomicity, Log-based recovery, Shadow paging, recovery with concurrent transactions, Buffer management, Failure with loss of non-volatile storage, Advanced recovery techniques, Remote Backup Systems.

Suggested Reading:
1. Abraham Silberschatz, Henry F Korth, S.Sudarshan, *Database System Concepts*, Mc Graw-Hill inc, 4th Ed., 2002,
2. Patrick O'Neil, Elizabeth O'Neil, *Data Base Principles-Programming and Performance*, Morgan Kaufmann, 2nd Ed., 2001.
3. R.Elmasri, Navathe, *Fundamentals of Database Systems,* Addition Wesley, 1994.

EC 423 UE

VLSI TECHNOLOGY

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks

OBJECTIVES:
  a. Professional training to the students of computer Science, computer applications, computer engineering, physics and electronics students in VLSI Technology and Hardware Description Language

UNIT I
Overview of CMOS &BiCMOS technologies, MOS &BiCMOS Transistor Models, IC fabrication, MOS inverter characteristics.

UNIT II
IC Layout Design of basic structures & simulation, static MOS Gate circuits.

UNIT III
Sub-system Design: Arithmetic circuits in CMOS and ROM, SRAM & DRAM Arrays.

UNIT IV
Process Technology – I

UNIT V
Process Technology – II
Polysilicon Film Deposition, Diffusion, Ion implantation and Metallization VLSI Process Integration-CMOS IC technology.

Suggested Reading:
1. David Hodges, Horace G Jackson &Resve A Saleh, *Analysis and design of Digital Integrated Circuits in Deep Submission Technology*, 3rd ed., TMH, 2005.
2. John P.Uymera, *Introduction to VLSI Circuits & Systems*, John Wiley & Sons 2002.
3. JM Rabacy, AchandraKasan and B.Nikahe, *Digital Integrated Circuits – A design perspective, 2nd Ed.*, HI 2003.
4. SM.SZE, *VLSI, Technology, 2nd Ed.*, Mc Graw Hill Company, 1988.

EE 405 UE

OPTIMIZATION TECHNIQUES

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

OBJECTIVES:
   a. Provide students with the tools and mentality of optimization.
   b. Present classic and recent research topics in optimization of communication systems.
   c. Introduce the tools just in time for the application topics.
   d. Train the ability to do original research in academia or industry through final projects that are closely related to students' own research interests.

UNIT I
Introduction to Classical Optimization Techniques: Statement of optimization problem, Objective function, Classification of Optimization problem.
Classical optimization techniques: Single-variable and Multi-Variable optimization without constraints. Multi-variable optimization with equality constraints. Lagrange multiplier method, Multi-Variable optimization with inequality constraints, Kuhn-Tucker conditions.

UNIT II
Linear Programming: Standard form, formulation of the LPP, Solution of simultaneous equations by pivotal condensation, Graphical methods, Simplex algorithm, Big M Method, Two phase Simplex method, Duality principle, Dual Simplex method.

UNIT III
Non-linear Programming:
One-dimensional search methods. Fibonacci method, Golden section method, Direct Search method: Univariate Search and Pattern Search methods, Powell's method.

UNIT IV
Gradient Method: Steepest Descent, conjugate Gradient and Quasi-Newton method, Fletcher-Reeves method of Conjugate gradients.

UNIT V
Dynamic Programming: Multistage design process, Types, Principle of optimality, Computational procedure in Dynamic programming, Examples using Calculus method and Tabular method of solutions.

Suggested Reading:
1. S.S.Rao, *Optimization Theory and Application*, New Age International, 3rd Ed. 1998.
2. JasbirS.Arora, *Introduction to Optimum Design*, Mc Graw Hill international Ed., 1989
3. S.D.Sharma, *Operational Research*, KedarnathRamnath& co., 2004.

ME 409 UE

ENTREPRENEURSHIP

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

OBJECTIVES:
a. The purpose of this paper is to prepare a ground where the students view entrepreneurship as a desirable and feasible career option. In particular the paper seeks to build the necessary competencies and motivation for a career in entrepreneurship.

UNIT I
Indian Industrial Environment – competence; Opportunities and Challenges, entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, linkages among small, medium and heavy industries and forms enterprises.

UNIT II
Identification and characteristics of Entrepreneurs, Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas, their sources and decision making, Choice of Technology – Collaborative interaction for Technology development.

UNIT III
Project formulation, Analysis of marked demand, Demand supply gap, Financial and Profitability analysis and Technical analysis. Project financing in India.

UNIT IV
Project Management during construction phase, project organization, project planning and control using CPM-PERT techniques. Human aspects of project management. Assessment of tax burden.

UNIT V
Behavioral aspects of entrepreneurs: Personality – determinants, attributes and models, leadership concepts and models. Values and attitudes. Motivation aspects, change behaviour.
Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and the time management matrix.

Suggested Reading:
1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, 1997.
2. Prasanna Chandra, Project – *Planning, Analysis, Selection, Implementation and Review,* Tata Mc Graw Hill Publishing Company Ltd., 1995.
3. B.Badhai, *Entrepreneurship for Engineers*, Dhanpathrai& Co., Delhi, 2001.
4. Stephen R. Covey and A.RogerMerril, *First Things First*, Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, *Entreneurship,* Tata Mc Graw Hill ed., 2002.

ME 412 UE

FINITE ELEMENT ANALYSIS

Instruction: 4 Periods per week
Duration of University Examination: 3 Hours
University Examination 75 Marks
Sessional: 25 Marks

OBJECTIVES:

    a. Understand the basic assumptions of Linear Static Finite Element Analysis (FEA)
    b. Understand basic FEA terminology
    c. Be familiar with some of the limitations of Linear Static FEA
    d. Comprehend considerations of the solid or planar CAD model relevant to the FEA model
    e. Be able to run a basic FEA analysis

UNIT I

Introduction to Finite Element Method for solving field problems. Stress and Equilibrium. Boundary conditions. Strain Displacement relations, Stress-strain relations. One Dimensional problems: Finite element modeling, coordinates and shape functions, Potential Energy approach: Assembly of Global stiffness matrix and load vector, Finite element equations. Treatment of boundary conditions, Quadrate shape functions.

UNIT II

Analysis of trusses and frames: Element stiffness matrix for a truss member. Analysis of Plane truss with number of unknowns not exceeding two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node. Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node beam element.

UNIT III

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Finite element modeling of Axisymmetrix solids subjected to Axisymmetrix loading with triangular elements.

UNIT IV

Two dimensional four nodded isoparametric elements and numerical integration. Steady state heat transfer analysis: One dimensional analysis of a fin and two dimensional analysis of this plate. Analysis of a uniform shaft subjected to torsion.

UNIT V

Dynamic Analysis: Formulation of finite element model, element matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam. Time dependent field problems: Application to one dimensional heat flow in a rod. Finite element formation to three-dimensional problems in stress analysis. Convergence requirements and geometric isotropy. Local, natural and global coordinates. Introduction to Finite Element Analysis Software.

Suggested Reading:

1. Tirupathi, R.Chandraputla and Ashok D. Belegunde, *Introduction to Finite Elements in Engineering*, Pearson Education, 3rd Ed., 2002.
2. Rao S.S., *The Finite Element Methods in Engineering*, Pergamon Press, 1989.
3. Segerlind L.J., *Applied Finite Element Analysis*, Wiley Publication, 1984.
4. Reddy J.N., *An Introduction to Finite Element Method*, McGraw Hill Co., 1984.

MEDI EMBEDDED SYSTEMS LAB

Instruction: 3 Periods per week
Duration of University Examination: 3 Hours
University Examination   50 Marks
Sessional: 25 Marks

1. Interfacing with ARM-7 and MSP430F54xx
   a) Study and analysis of interfacing of LED.

   b) Study and analysis of interfacing of switches.

   c) Study and analysis of interfacing of 12 bit internal Alphanumeric LCD.

   d) Study implementation analysis and interfacing of 4x4 matrix keypad.

   e) Study of I2C based EEPROM interfacing

   f) Study of SPI based EEPROM interfacing

   g) Study of Stepper Motor interface

   h) Study of Stepper Motor interfacing and its Direction and Angle Control

   i) Study of DC Motor interfacing and its Direction Control

   j) Study of Servo Motor interfacing and its Angle Control

   k) Study of PWM concept

2. Interfacing of matrix sensors to PIC microcontroller
   a) Pin to pin study of MCU

   b) To study of initialization of internal fix PWM

   c) To study of Initialization of internal PWM with variable duty cycle using Internal ADC

   d) Heart rate monitor

   e) ECG sensor

BM 481 UE

BIOMEDICAL SIGNAL PROCESSING & IMAGING PROCESSING LAB

Instruction:	4 Periods per week
Duration of University Examination:	3 Hours
University Examination	75 Marks
Sessional:	25 Marks
Credits	4

Experiments on Signal Processing

1. Use of DSP processors-6X and 2X series for
   - (i) Generation of basic signals.
   - (ii) Linear and circular convolution
   - (iii) Realization of FIR and IIR filters
   - (iv) Finding DFT and IDFT of given sequence
   - (v) Plotting the power spectral density.
2. Computation of convolution and correlation sequences.
3. Signal averaging improvement in the SNR Using coherent and incoherent averaging.
4. Exponential averaging.
5. Data polishing: mean and trend removal
6. Design of IIR and FIR Filter
7. PSD Estimation
8. AR Modeling for Predictive Filters
9. LMS Based Algorithm for Adaptive Noise Canceling
10. Data Compression Techniques: AZTEC, TP, CORTES, KL Transform
11. Template matching algorithm for QRS detection
12. Classification of EEG waves.

Experiments on Image Processing

1. Reading and displaying JPEG and BMP images.
2. Negative of an image.
3. Contrast Stretching
4. Logarithmic Transform.
5. Power-law Transform.
6. Transpose of an image.
7. Filtering in spatial domain
   a. High pass filter.
   b. Low pass filter
   c. Laplacianfilter.
8. Filtering in frequency domain
   a. Low pass filter
   b. High pass filter
   c. Butterworth low-pass & high-pass filters.
   d. Gaussian low pass& high pass filter
9. determine the image after applying the threshold
10. Highlight a specific range of gray levels in a given image.
11. Enhance the given image by Histogram processing&Histogram Equalization.
12. Edge detection operators

BM 432 UE

PROJECT SEMINAR

Instruction: 3 Periods per week

Sessional: 25 Marks

The Objective of the project seminar is to actively involve the student in preparation of the final year project with regard to following components

- Problem definition and specifications
- Literature survey, familiarity with research journals
- Board knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar (activity) charts.
- Presentation - Oral and Written.

The Department can initiate the work related to project allotment at the end of III year 2nd semester and finalize it in the first two weeks of the IV year 1st semester.

First 4 weeks of IV year 1st semester will be spend on special lectures by faculty members, research scholars and PG students of the department and invited lectures by engineers from industries and R&D institutions. The objective of these preliminary talks will be to expose students to real life practical problems, and methodology to solve the technical problems.

Seminar schedule will be prepared by the coordinator for all the students from 5th week to the last week of the semester which should be strictly adhered to.

Each student will be required to

1. Submit a one page synopsis before the seminar for display on notice board.
2. Give a 20 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write-up on the talk delivered.
4. Actively participate in the seminars.

At least two teachers will be associated with the evaluation of the project seminar for the award of the Sessional marks, which should be on the basis of performance on all the three items stated above.

Note: Three periods will be assigned to each project guide irrespective of the number of projects guided.