Course code	Course Name	L-T-P-Credits	Year of Introduction
BM301	BIOMEDICAL SIGNALS & SYSTEMS	3-1-0-4	2016

Prerequisite : Nil

Course Objectives

- To familiarize various kinds of signals and their characteristics
- To introduce various systems
- To understand transform techniques
- To understand FFT algorithms.

Syllabus

Introduction to Biomedical signals - Continuous time and discrete time signal representation - Classification of signals - Continuous time and discrete time systems - LTI system – Convolution – Correlation - LTI described by differential and difference equations - Laplace transform – inverse Laplace transform – properties - analysis of LTI using Laplace transform - Sampling theorem. Z-transform - inverse Z-transform-properties of Z - transform-analysis of LTI using Z-transform. Fourier series and Fourier transform - discrete time Fourier series and Fourier transform - FFT algorithms.

Expected Outcome

After the completion of the course, students will be able to

i. Understand basic concepts of signals and systems.
ii. Get an idea on transforming signals and its advantage.
iii. Study various signal processing algorithms

Text Books:

1. Alan V Oppenheim, Alan S Willsky, Signals and Systems. Prentice Hall India, 2/e, 2010.
2. P. Ramesh Babu: Digital Signal Processing, Scitech Publications, India 2004.

Reference Books:

1.John G Proakis & Dimitris G Manolakis, Digital Signal processing-Principles, Algorithms and Applications, PHI

2.Sanjit K. Mithra, Digital Signal Processing, Tata McGraw Hill, 3rd ed.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to biomedical signals- ECG, EMG, EEG, , carotid pulse, - properties, characteristics of bio signals - challenges in processing - low amplitude low frequency signals.	3	15%
	Introduction to elementary signals - exponential and sinusoidal - unit step and impulse - mathematical representation.	3	
	Classification of signals - Energy and Power signals - Continuous time -periodic, even and odd signals.	3	
II	Continuous time & Discrete time systems - Basic system properties - Causality, stability, Time invariance, linearity.	4	15%
	Discrete time LTI –convolution – correlation - Properties of	3	

	LTI (problems).		
	LTI Systems described by differential and difference equations and calculation of impulse responses.	3	
FIRST INTERNAL EXAM			
III	Laplace transform - Region of convergence - The inverse Laplace transform - Properties of the Laplace transform.	5	**15%**
	Analysis and characterization of First-order and second-order LTI systems using the Laplace transform.	4	
IV	Sampling – Introduction - Representation of a continuous-time signal by its samples - the sampling theorem - Under sampling – effects - aliasing (problems).	4	**15%**
	Fourier Series and Transforms - The response of continuous-time LTI systems to complex exponentials.	2	
	Fourier series representation of Continuous time periodic signals - Convergence of Fourier series-properties.	3	
SECOND INTERNAL EXAM			
V	Continuous-time Fourier transform representation of Aperiodic signals – Fourier transform of periodic signals – Properties.	3	**20%**
	Fourier transform and Fourier series pairs.	1	
	discrete-time Fourier series - Properties - FFT algorithms - DIT and DIF.	5	
VI	The z-transform - The region of convergence - Properties of the z-transform - Inverse z-transform.	7	**20%**
	Analysis and characterization of LTI systems using z-transforms.	3	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM303	BIOSENSORS & TRANSDUCERS	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To understand the basic principles of biological sensors in the body
- To understand the principles behind chemical analysis of body fluids
- To understand the principles of measurement using biosensors.
- To impart fundamental measurement techniques using transducers and transduction mechanisms.

Syllabus

Transducers and sensors: Study of biological sensors in human body and their basic mechanism of action. Study of various Chemoreceptors, hot and cold receptors, baroreceptors, sensors for smell, sound, vision, osmolality and taste. Bio sensors -Ion exchange membrane electrodes-oxygen electrodes - Chemical Transducers: Transducers for the measurement of ions and dissolved gases. Reference electrodes - Hydrogen electrodes - silver-silver chloride electrodes -Calomel electrodes. Measurement of pH - Glass pH electrodes. Temperature transducers, Displacement transducers, Pressure transducer.

Expected Outcome

- After the completion of the course, students will be able to acquire knowledge about bio sensors, chemo receptors and biomedical transducers.

Text Books:

1. Keith Brindley, Sensors & Transducers, Heinemann Newnes, Great Britain, 1988.
2. R S C Cobbold, Transducers for Biomedical Instruments, John Wiley & Sons, 1974.

Reference Books:

1. A V S De Reuck, Touch Heat & Pain, J & A Churchill Ltd. London, 1967.
2. Avraham Rasooly & Keith E. Herold, Biosensors and Bio detection, , Vol 503.
3. Brown & Gann, Engineering Principles in Physiology Vol. IAcademicPress,1973
4. D L Wise , Applied Bio Sensors, Butterworth Publishers, London 1989
5. E. Galindo , BIOTECHNOLOGY – Vol. II - Biosensors
6. Geddes & Becker, Principles of Applied Biomedical Instrumentation, John Wiley, 1989.
7. Harry Thomas , Handbook of Bio medical Instrumentation, Reston, Virginia 2000
8. Iberall & Guyton , Regulation & Control in Physiological System, Instruments Society USA
9. R S Khandpur, Handbook of Bio medical Instrumentation, Tata McGraw Hill, 2004.
10. Xueji Zhan , Electrochemical Sensors, Biosensors and their Biomedical Applications 1st Edition ,

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Sensors : Study of biological sensors in human body and their basic mechanism of action	3	15%
	Organization of nervous system-neuronal mechanism and	4	

	circuit processing. Transducers –types and classification-active and passive.		
II	Introduction to bio sensor-classification based on bio recognition element - Enzymatic, DNA, antigen-antibody	**4**	**15%**
	Classification based on signal transduction - electro chemical, optical, colorimetric, piezoelectric	**3**	
FIRST INTERNAL EXAM			
III	Study of various Chemoreceptors, hot and cold receptors, baro receptors	**3**	**15%**
	Sensors for smell, sound, vision, osmolality and taste	**2**	
	Chemical Transducers: Transducers for the measurement of ions and dissolved gases	**2**	
IV	Reference electrodes - oxygen electrodes - CO_2 electrodes enzyme electrode -construction -Hydrogen electrodes	**3**	**15%**
	Silver-silver chloride electrodes-Calomel electrodes. Measurement of pH - Glass pH electrodes	**2**	
	Catheter tip electrodes for the measurement of pO_2 and pCO_2	**2**	
SECOND INTERNAL EXAM			
V	Temperature transducers –thermo resistive transducers, thermoelectric, p-n junction, chemical thermometry	**4**	**20%**
	Flow and velocity transducers-principle and working	**3**	
VI	Displacement & Pressure transducers: Potentiometric -resistive strain gauges, inductive -capacitive - piezo electric transducers measurement of blood pressure - sphygmomanometer -indirect method - based on Korotkoff sound, oscillometric method	**5**	**20%**
	Direct method- catheter tip and catheter type transducers	**2**	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM305	ADVANCED MICROPROCESSORS & MICROCONTROLLERS	3-0-0-3	2016

Prerequisite: IC206 Microcontrollers

Course Objectives

- To get an insight to the architecture, registers and addressing modes of advanced microprocessors
- To study in detail 8086,80386 and Pentium
- To study in detail salient features and programming of PIC microcontroller

Syllabus

8086 Microprocessor - Architecture, Register organization, Signal descriptions, Physical Memory organization, Maximum and Minimum mode operations, Addressing Modes. 80386 Microprocessor: Salient features, Architecture and Signal Description, Register Organization, Addressing Modes. Pentium: Salient features, pipelining and super scalar architecture. PIC Microcontroller: Introduction, Architectural Overview, Memory Organization, Data Memory and Flash Memory, Addressing modes, Interrupts and Reset.

Expected Outcome

- At the end of the course students will be able to design and implement systems using advanced microprocessors and microcontrollers in their future projects.

Text Books:

1. A.K. Ray, K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", 2" Edition, Tata Mc GrawHill, 2006.
2. John B Peatman, "Designing with Microcontrollers", Ist edition, Mc Graw Hill International
3. Lyla B. Das, The x86 Microprocessors: Architecture, programming and Interfacing (8086 to Pentium), Pearson Education,2010, ISBN 978-81-317-3246-5

Reference Books:

1. Bamett, Cox & O'Cull, "Embedded C Programming and the Microchip PlC" Thomson India Edition, 2007.
2. Barry B. Brey, The Intel Microprocessors 8086/8088,80286, 80386 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing, Prentice Hall of India Private Limited, New Delhi, 2003.
3. D. V. Hall, "Microprocessor and Interfacing Programming & Hardware" TMH.
4. Daniel Tabak , "Advanced Microprocessors" McGraw Hill Inc., 1995
5. James L. Antonakos," An Introduction to the Intel family of Microprocessors '' Pearson Education 1999.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Microprocessor Architecture - 8086, Register organization of 8086, Signal descriptions of 8086 chip, Physical Memory organization, Introduction to Maximum and Minimum mode	7	15%

	operation- Addressing Modes.		
II	Instruction set & assembler directives: Machine language Instruction format Instruction set – Assembler directives & operators. Simple assembly language programming. Introduction to Stack, Interrupts & Interrupt service routines.	7	**15%**
FIRST INTERNAL EXAM			
III	Introduction to Subroutines, Recursion, MACROS – Timing & delays.	3	**15%**
	Programmable interfacing devices: Programmable peripheral interface (Intel 8255), Programmable timer interface (Intel 8253/ 54).	4	
IV	32-bit Microprocessors: 80386 - Salient features, Architecture and Signal Description, Register Organization and Addressing Modes. Real Address mode, Protected mode Segmentation, Paging & Virtual modes.	6	**15%**
	Pentium - General features, pipelining and super scalar architecture.	3	
SECOND INTERNAL EXAM			
V	PIC Microcontroller: Introduction, Architectural Overview, Memory Organization, Data Memory and Flash Memory.	6	**20%**
VI	Instruction set, Addressing modes, Interrupts and Reset.	6	**20%**
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM307	HOSPITAL ENGINEERING	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To gain knowledge about the role of a biomedical engineer in hospitals and society at large.
- To familiarize the electrical power, air conditioning and refrigeration systems in hospitals.
- To get an insight into the set up of operation theatres and the working of different sterilization and cryogenic systems in hospitals.
- To familiarize the gas supply systems in hospitals.

Syllabus

Definitions of Bioengineering, Biomedical Engineering, Clinical engineering & Hospital engineering. Hospital architecture – roles & responsibilities of biomedical engineer - patient safety – hospital accreditation & certification protocols. Electrical power & protective systems in hospitals – other safety measures - air conditioning and refrigeration systems - sterilization - operation theatres, gas supply systems, dry & oil free air compressor.

Expected Outcome

After the completion of the course, students will be able to

- Understand the roles & responsibilities of a biomedical engineer
- Understand the areas of attention required from a biomedical engineer in clinical environment.

Text Books:

- C A Caceres ,Clinical Engineering, Academic Press, New York,1977

Reference Books:

1. S Ward, Aneasthetic Equipments, W. B. Saunders, London, 1985.
2. Anantha Narayanan , Basic Refrigeration and Air Conditioning, 2ndedition, TMH 1996 2002.
3. Kutz Myer, Standard Handbook of Biomedical Engineering, & Design, McGraw Hill,
4. B. N. Feinberg, CRC Handbook of Clinical Engineering, CRC Press, 1980.
5. Richard L. Miller, Earl S. Swensson Hospital and Healthcare Facility Design" W. W. Norton & Company; 2nd edition 2002
6. John Douglas McDonald "Electric Power Substations Engineering"–2003 CRC Press
7. Alexander Kusko, Emergency and Stand by Power Systems1989 -McGraw-Hill

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Definition of Bio-Engineering, Biomedical Engineering, Clinical engineering & Hospital engineering	1	15%
	Modern Hospital Architecture – Various departmental Planning & Design (Radiology Dept, Nuclear Medicine, ICU, Central Sterilization and Operation Theaters) Space distribution in a hospital building.	2	
	Role & responsibilities: Setting up of Biomedical department in a Hospital (Requirements & facilities) - Procurement procedure - purchase & contract procedures (CMC and AMC), selection, testing and calibration, installation and training to medical staff – operating instructions. Repair & maintenance of medical	4	

	equipments: Troubleshooting and repairing of medical equipment, Preventive maintenance.		
II	Patient safety – electrical shocks and hazards – micro and macro shocks – effects of electrical current on human body – ventricular fibrillation - leakage currents – types & measurements.	4	**15%**
	Hospital Accreditation Protocols - ISO &IEC standards, NABH, AERB and JCI certification. Case study on a hospital DBMS	3	
FIRST INTERNAL EXAM			
III	Electrical power systems in hospitals -Design of sub stations wiring in hospitals. Stabilized and uninterrupted power supply systems.	3	**15%**
	Protective systems: Over voltage and over current protectors, circuit breakers, Surge protectors, EMI filters.	2	
	Introduction to safety measures: Electrical, Fire, Gas, Radiation and its surveillance systems.	1	
IV	Basics of air conditioning and refrigeration systems, Air changes, filtering & sterility- Concept of Clean Room Air Handling Unit De-odourisation, disinfection and dehumidification.	3	
	Sterilization systems in hospitals: Principles and techniques of sterilization - Steam & EO sterilization.	3	**15%**
	Autoclaves, Incinerators. An overview of Safe management of wastes from health-care activities.	3	
SECOND INTERNAL EXAM			
V	Design of operation theatres – theatre lighting, OT tables	3	**20%**
	Stretchers & wheel chairs - Cryogenic systems for hospitals.	3	
VI	Hospital gas supply systems - Centralized supply of air, nitrous oxide, vacuum & oxygen - principle of production of liquid oxygen.	4	**20%**
	Working of dry, oil free air compressor.	2	
END SEMESTER EXAM			

Note: *The assignment shall be a presentation and submission of the report of a visit to a hospital to observe & understand the various aspects covered in the syllabus. The visit shall be conducted as groups of maximum four members during the break between the 4th & 5th semesters for a minimum duration of 1 week in a hospital of student's choice.*

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P - Credits	Year of Introduction
HS300	Principles of Management	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To develop ability to critically analyse and evaluate a variety of management practices in the contemporary context;
- To understand and apply a variety of management and organisational theories in practice;
- To be able to mirror existing practices or to generate their own innovative management competencies, required for today's complex and global workplace;
- To be able to critically reflect on ethical theories and social responsibility ideologies to create sustainable organisations.

Syllabus

Definition, roles and functions of a manager, management and its science and art perspectives, management challenges and the concepts like, competitive advantage, entrepreneurship and innovation. Early contributors and their contributions to the field of management. Corporate Social Responsibility. Planning, Organizing, Staffing and HRD functions, Leading and Controlling. Decision making under certainty, uncertainty and risk, creative process and innovation involved in decision making.

Expected outcome.

A student who has undergone this course would be able to

i. manage people and organisations
ii. critically analyse and evaluate management theories and practices
iii. plan and make decisions for organisations
iv. do staffing and related HRD functions

Text Book:

Harold Koontz and Heinz Weihrich, *Essentials of Management*, McGraw Hill Companies, 10th Edition.

References:

1. Daft, *New era Management*, 11th Edition, Cengage Learning
2. Griffin, *Management Principles and Applications*, 10th Edition, Cengage Learning
3. Heinz Weirich, Mark V Cannice and Harold Koontz, *Management: a Global, Innovative and Entrepreneurial Perspective*, McGraw Hill Education, 14th Edition
4. Peter F Drucker, *The Practice of Management*, McGraw Hill, New York
5. Robbins and Coulter, *Management*, 13th Edition, 2016, Pearson Education

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Management: definitions, managerial roles and functions; Science or Art perspectives- External environment-global, innovative and entrepreneurial perspectives of Management (3 Hrs.)– Managing people and organizations in the context of New Era- Managing for competitive advantage - the Challenges of Management (3 Hrs.)	6	15%

II	**Early Contributions and Ethics in Management**: Scientific Management- contributions of Taylor, Gilbreths, Human Relations approach-contributions of Mayo, McGregor's Theory, Ouchi's Theory Z (3 Hrs.) Systems Approach, the Contingency Approach, the Mckinsey 7-S Framework Corporate Social responsibility- Managerial Ethics. (3 Hrs)	6	15%
FIRST INTERNAL EXAMINATION			
III	**Planning:** Nature and importance of planning, -types of plans (3 Hrs.)- Steps in planning, Levels of planning - The Planning Process. – MBO (3 Hrs.).	6	15%
IV	**Organising for decision making:** Nature of organizing, organization levels and span of control in management Organisational design and structure –departmentation, line and staff concepts (3 Hrs.) Limitations of decision making-Evaluation and selecting from alternatives- programmed and non programmed decisions - decision under certainty, uncertainty and risk-creative process and innovation (3 Hrs.)	6	15%
SECOND INTERNAL EXAMINATION			
V	**Staffing and related HRD Functions:** definition, Empowerment, staff – delegation, decentralization and recentralisation of authority – Effective Organizing and culture-responsive organizations –Global and entrepreneurial organizing (3 Hrs.) Manager inventory chart-matching person with the job-system approach to selection (3 Hrs.) Job design-skills and personal characteristics needed in managers-selection process, techniques and instruments (3 Hrs.)	9	20%
VI	**Leading and Controlling:** Leading Vs Managing – Trait approach and Contingency approaches to leadership - Dimensions of Leadership (3 Hrs.) - Leadership Behavior and styles – Transactional and Transformational Leadership (3 Hrs.) Basic control process- control as a feedback system – Feed Forward Control – Requirements for effective control – control techniques – Overall controls and preventive controls – Global controlling (3 Hrs.)	9	20%
END SEMESTER EXAM			

Question Paper Pattern

Max. marks: 100, Time: 3 hours .
The question paper shall consist of three parts

Part A: 4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part B : 4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)
Part C: 6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM361	COMMUNICATION TECHNIQUES	3-0-0-3	2016

Prerequisite : Nil

Course Objectives

- To study different types of communication and the effect of noise in communication.
- To study the importance and different methods of modulation
- To get an introduction to digital Communication.

Syllabus

Introduction to communication systems: Definitions & elements – types – Modulation – Channel & Noise. Amplitude modulation: Frequency spectrum – modulation index - AM Generation – SSB –ISB, VSB, AM Transmitter and receiver (Block level). Angle modulation: FM - bandwidth requirement. Generation – FM transmitters & receivers. Phase modulation. Pulse modulation – Need, & different types and principles of operation. Introduction to digital communication: digital codes – Modems & interfacing.

Expected Outcome

After the completion of the course, students will be able to

i. Understand the fundamental concepts of communication systems
ii. Compare different modulation schemes.
iii. Understand the application of amplitude and frequency modulation.
iv. Able to detect and correct the errors that occur due to noise during transmission

Reference Books:

1. Dennis Roody and John Coolen: Electronic Communication, Prentice Hall of India, New Delhi.
2. George Kennedy & Davis: Electronic communication Systems, Tata Mc Graw Hill, 1999.
3. Sam Shanmugham: Digital and Analog Communication Systems, John Wiley & Sons, 1985.
4. Taub and Schilling: Principles of Communication Systems, Mc Graw Hill.1987
5. William Schweber: Electronic Communication Systems – A complete course, 4th edition, Prentice Hall of India, 2002.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to communication systems–Definition of communication Information –transmitter –receiver.	2	15%
	Analog and digital communication systems –comparison, Need for modulation.	2	
	Channel –noise –white noise –narrow band noise–noise figure	3	
II	Amplitude modulation: Frequency spectrum –representation of AM, modulation index.	3	15%
	Power relations in AM wave - AM Generation – modulated transistor amplifier (one example).	4	
FIRST INTERNAL EXAM			

III	Evolution and description of SSB – Balanced modulator	3	**15%**
	Suppression of unwanted sideband – extension of SSB - ISB, VSB, AM Transmitter and receiver (Block level).	3	
IV	Angle modulation: Frequency modulation - mathematical representation, waveforms, frequency deviation, bandwidth requirement	3	**15%**
	Generation of FM – direct & indirect methods – FM transmitters. FM receivers - block diagram – demodulators – balanced slope detector. Phase modulation.	4	
SECOND INTERNAL EXAM			
V	Pulse modulation–Need for pulse modulation – different types	4	**20%**
	Pulse Width Modulation, Pulse Position Modulation and Pulse Code Modulation – principles of operation	4	
VI	Introduction to digital communication: digital codes – error detection and correction – redundant codes, parity check codes, forward error correcting codes	4	**20%**
	Modems – classification, modes of operation, modem interfacing.	3	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM363	PRINCIPLES OF ERGONOMIC DESIGN	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To Introduce the Concept of Human Factors in Engineering & Design.
- To understand human body Physiological Factors in Work.
- To Introduce different Factors of Manual Material Handling (MMH)
- To understand thoroughly the concepts of Compatibility in Designing Displays and controls.
- To apply Anthropometric principles in Designing Workspace and Seat.
- To enquire basic causes of Errors & Accidents.

Syllabus

Introduction to Human factors Engineering, Visual Capabilities of Human Beings, Human factor aspects of hard copy text, computer screen text, graphics, symbols, codes. Qualitative & Quantitative visual displays, Principles of auditory displays. Efficiency, Energy Consumption &Work rest cycles.

Human Factors aspects of manual material handling (MMH). Compatibility Principles & Types, Rotary controls and rotor displays movement of displays, Control orders and control responses, Tracking, Anthropometric design principles, Work space envelope, Principles of seat design, Errors& Accidents

Expected Outcome

At the end of the course students will be able to

i. Appreciate the relevance of Human Factors in Engineering Design.
ii. Examine anthropometric factors in Workspace design and propose best Engineering design.
iii. Suggest practices to avoid errors & accidents in workspace.

Reference Books:

1. Mark S. Sanders & Ernest J. McCormic, Human Factors in Engineering and Design, McGraw Hill international Edition, 1993.
2. Terence S. Andre, Aaron W. Schopper, Human Factors Engineering in System Design, British Columbia Teacher, 1997.
3. Wesley E. Woodson, Human Factors Design Handbook, McGraw-Hill Professional; 2nd edition, 1992.

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Introduction to Human factors Engineering.	1	15%
	Relevance of Ergonomics.	3	
	Process of seeing, Visual capabilities, Factors affecting Visual acuity and Contrast sensitivity. Human factor aspects of hard copy text and computer screen text.	3	

II	Factors in selecting graphic representations, symbols. Qualitative visual displays, Quantitative visual displays.	**4**	**15%**
	Process of hearing.	**1**	
	Principles of auditory displays.	**2**	
FIRST INTERNAL EXAM			
III	Muscle physiology, Muscle metabolism.	**2**	**15%**
	Measure of physiological in-efficiency and energy consumption, Work rest cycles.	**3**	
	Aspects of manual material handling (MMH). Bio-mechanical recommended limits of MMH.	**3**	
IV	Spatial compatibility, Physical arrangement of displays and controls, Movement capability, Rotary controls and rotor displays movement of displays, Orientation of the operator and movement relationships.	**5**	**15%**
	Control orders and control responses, Human limitations in tracking task.	**2**	
SECOND INTERNAL EXAM			
V	Anthropometry, Anthropometric design principles	**2**	**20%**
	Work space envelope, Factors in design of workspace surfaces, Principles of seat design, Principles of control panel organization.	**5**	
VI	Classification of human errors, Dealing with human errors	**3**	**20%**
	Theories of accident causation, Reducing accidents by altering behavior. Risk, Warning & Liability	**3**	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM365	BIOINFORMATICS	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To develop basic understanding about computational Biology and Bioinformatics.
- To inculcate skills in sequence analysis and structure modelling.
- To impart knowledge on molecular mechanism of diseases and drug action and to develop appreciation about computational drug design techniques.
- To expose students to basic concepts & algorithms in Bioinformatics based on molecular data and to impart skills in use of popular computing tools in this area.

Syllabus

Basic Concepts of Molecular Biology, Genomes and Genes, Gene expression, Web based genomic and proteomic data bases, Sequence alignments, Algorithms, Genomic Signal Processing, Introduction to NGS technology, RNA-seq, ChIP-seq analysis , Quantification of DNA, RNA and Protein using various Biochemical methods, Molecular modelling in drug discovery, Pharmacodynamics, Pharmacokinetics, Visualization of Molecular Structures, Introduction to systems biology, Enzyme Kinetics and Thermodynamics , Interaction networks overview, Tools for systems Biology.

Expected Outcome

The student will be able to

i. use tools and software for bioinformatics analysis

ii. apply basic genomic and transcriptomic sequence processing algorithms and popular software tools in this area.

Reference Books:

1. Setubal &Meidanis, *Introduction to Computational Molecular Biology*, Thomson: Brooks/Cole, InternationalStudent Edition, 2003.
2. Claverie&Notredame, *Bioinformatics - A Beginners Guide*, Wiley- Dreamtech India Pvt Ltd, 2003.
3. Lesk, *Introduction to Bioinformatics*, Oxford University Press, Indian Edition, 2003
4. Higgins and Taylor, *Bioinformatics: Sequence, structure and databanks*, Oxford University Press, Indian Edition, 2003
5. Zvelebil, M. J., & Baum, J. O. (2008). *Understanding bioinformatics*. Garland Science.
6. DovStekel, *Microarray Bioinformatics*, Cambridge University Press
7. Rastogi, S. C., Mendiratta, N., &Rastogi, P. (2013). *Bioinformatics: Methods and Applications: (Genomics, Proteomics and Drug Discovery)*. PHI Learning Pvt. Ltd.
8. K Anand Solomon (2008) Molecular Modelling and Drug Design, MJP Publishers
9. Alon, U. (2006). *An introduction to systems biology: design principles of biological circuits*. CRC Press.
10. Klipp, E., Liebermeister, W., Wierling, C., Kowald, A., Lehrach, H., &Herwig, R. (2013). *Systems biology*. John Wiley & Sons.

Course Plan			
Module	**Contents**	**Hours**	**Sem. Exam Marks**
I	Basic Concepts of Molecular Biology: Cells - Chromosomes, DNA, RNA, Proteins, Central dogma of molecular biology,	1	15%
	Genomes and Genes - Genetic code, Transcription, Translation and Protein synthesis.	2	
	Gene expression, Microarrays, Microarray image analysis	2	
	Web based genomic and proteomic data bases: NCBI, Gen Bank	2	
II	Sequence alignments – Dot plot-Pair-wise sequence alignments, Local and global -Sequence similarity and distance measures.	1	15%
	Smith-Waterman algorithm, Needleman-Wunch algorithm, Multiple sequence alignment, PAM and BLOSUM, Phylogenetic analysis	3	
	Software tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, ClustalW	3	
FIRST INTERNAL EXAM			
III	Genomic Signal Processing, DNA Spectrograms, Identification of protein coding regions	2	15%
	Introduction to NGS technology, S Data analysis -Methods, Data formats, Data handling, Introduction to RNA-seq, ChIP-seq analysis	3	
	Quantification of DNA, RNA and Protein using various Biochemical methods, Amplification of DNA -Polymerase Chain Reaction	2	
IV	Molecular modelling in drug discovery, targets and receptors, target identification, small molecule drugs, Drug discovery pipeline	2	15%
	Pharmacodynamics, Pharmacokinetics, toxicology, formulations and delivery systems	2	
	Visualization of Molecular Structures, Molecular Descriptors, QSAR Methods	3	
SECOND SEMESTER EXAM			
V	Structure Based Virtual Screening in drug discovery, Molecular docking, Introduction to molecular dynamics.	2	20%
	Introduction to Systems Biology, Systems concept, feedback, control analysis in Biological systems.	2	
	Enzyme Kinetics and Thermodynamics, The Law of Mass Action; Reaction Kinetics, Rate Equation, Michaelis-Menten Equation, Hill Equation.	3	
VI	Interaction networks overview- Gene Regulatory Network, Protein – Protein Interaction Network, Signalling Pathways, Metabolic pathways; Network motifs.	4	20%
	Tools for systems Biology- Cell designer; Cytoscape.	3	
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

There shall be three parts for the question paper.

Part A includes Modules 1 & 2 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part B includes Modules 3 & 4 and shall have three questions of fifteen marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Part C includes Modules 5 & 6 and shall have three questions of twenty marks out of which two are to be answered. There can be subdivisions, limited to a maximum of 4, in each question.

Note: Each part shall have questions uniformly covering both the modules in it.

Course code	Course Name	L-T-P-Credits	Year of Introduction
IC365	DESIGN OF DIGITAL SYSTEMS	3-0-0-3	2016

Prerequisite: Nil

Course Objectives

- To study hazards in combinational and sequential circuits
- To review the fundamentals of finite state machines
- To study asynchronous sequential circuits
- To study various programmable logic devices
- To study the fundamentals of VHDL programming

Syllabus

Hazards – Clock skew – synchronizer failure and metastability – finite state machines – asynchronous sequential circuits, analysis and synthesis – designing with programmable logic devices: ROM, PAL, PLA, CPLD and FPGA devices - Introduction to VHDL programming.

Expected Outcome

After the completion of the course, students will be able to

i. Explain hazards in combinational and sequential circuits
ii. Design and implement synchronous sequential circuits
iii. Analyse and synthesise asynchronous sequential circuits
iv. Draw and explain architecture of important PLDs
v. Program simple digital circuits using VHDL

Text Book

- John F Wakerly, Digital Design- Principles and Practices(Third edition), Pearson

References

1. Bhasker J, A VHDL Primer, Addison Wesly.
2. Kevin Skahill 'VHDL for Programmable Logic' Pearson Education
3. Perry D.L, VHD, McGraw Hill
4. Roth C.H.Jr., Digital system Design using VHDL, PWS Pub.co
5. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with VHDL Design, TMH

Course Plan

Module	Contents	Hours	Sem. Exam Marks
I	Hazards - Static and Dynamic hazards- Design of hazard free circuits. Elementary ideas of Clock skew, synchronizer failure and metastability Review of synchronous sequential circuit design using finite state machines – Mealy & Moore Machines - ASM charts	8	15%

II	Asynchronous sequential circuits: Asynchronous behavior- Analysis of asynchronous circuits- Synthesis of asynchronous circuits- Race condition- State reduction- State assignment- Transition diagrams	8	**15%**
FIRST INTERNAL EXAM			
III	Designing with Programmable devices: ROM - Programmable Logic Arrays- Programmable Array Logicsequential-combinational PLDs (Eg: PAL14L4 &PAL12H6)	5	**15%**
IV	Sequential PLDs (Eg: PAL16R4)- Simple PLDs (Eg: 22V10)- Complex Programmable Logic Devices (Eg: XC9500)- Field Programmable Gate Arrays (Eg: XC 4000 & FLEX 10K)	7	**15%**
SECOND INTERNAL EXAM			
V	Introduction to VHDL: Entities and architectures- Behavioural, Data flow and structural descriptions- Identifies, Data objects, Data types and attributes- Delay models- Delta delays	7	**20%**
VI	VHDL codes for simple combinational and sequential circuits- State Machine Design, simple examples- Sub programs and packages	7	**20%**
END SEMESTER EXAM			

QUESTION PAPER PATTERN:

Maximum Marks: 100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4. Each question carries 15 marks and can have not more than four sub divisions. (15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6. Each question carries 20 marks and can have not more than four sub divisions. (20 x 2 = 40 marks)

Course code	Course Name	L-T-P - Credits	Year of Introduction
**341	DESIGN PROJECT	0-1-2-2	2016

Prerequisite : Nil

Course Objectives

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products, processes or systems
- To develop design that add value to products and solve technical problems

Course Plan

Study : Take minimum three simple products, processes or techniques in the area of specialisation, study, analyse and present them. The analysis shall be focused on functionality, strength, material, manufacture/construction, quality, reliability, aesthetics, ergonomics, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality, design for strength is not expected.

Note : The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.

Expected outcome .

The students will be able to

i. Think innovatively on the development of components, products, processes or technologies in the engineering field
ii. Analyse the problem requirements and arrive workable design solutions

Reference:

Michael Luchs, Scott Swan, Abbie Griffin, 2015. Design Thinking. 405 pages, John Wiley & Sons, Inc

Evaluation

First evaluation (Immediately after first internal examination)	20 marks
Second evaluation (Immediately after second internal examination)	20 marks
Final evaluation (Last week of the semester)	60 marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM331	MEDICAL ELECTRONICS LAB	0-0-3-1	2016

Course Objectives

- To design & set up op-amp based circuits used in biomedical instruments.
- To design and set up circuits using biomedical transducers.
- To familiarize with basic biomedical instruments.

List of Exercises/ Experiments (Minimum of 12 mandatory)

1. Bioamplifier
2. Phase detector
3. Notch filter
4. First order and second order high pass and low pass filters
5. Precision rectifiers (Half wave and Full wave).
6. UJT relaxation oscillator
7. Band pass filter
8. DC power control using SCR.
9. Study of IC 555 and its applications
10. Study of IC 4051 and its applications
11. Design of pacemaker circuits & Characterization
    i. Fixed type
    ii. Demand type
12. Digital to analog converter
13. Thermistor characteristics
14. Skin contact impedance
15. Study of LDR & its characteristics
16. Basic principle of biotelemetry using IC 4046. (Transmitting ECG signals)
17. High voltage and low voltage regulators
18. Study of medical equipments
    1. ECG
    ii. Sphygmomanometer
    iii. Analytical equipments such as colorimeter, pH meter, HB meter

Equipment needed: Bread boards, power supplies and electronic measuring equipments.

Expected Outcome

After the completion of the course, students should be able to

i. Know the basic biomedical equipments and their troubleshooting methods.
ii. Design and set up biomedical equipments

Text Books:

1. Boylestead & Neshelsky, Electronic Devices & Circuit Theory, Prentice Hall of India.2003
2. Millman & Halkias, Electronic Devices & Circuits, Tata McGraw Hill, New Delhi.1996
3. Ramakant A. Gayakwad, Op-Amp and Linear Integrated Circuits", Pearson Education Asia. 4thed.

Course code	Course Name	L-T-P-Credits	Year of Introduction
BM333	MICROPROCESSORS & MICROCONTROLLERS LAB	0-0-3-1	2016

Prerequisite: BM305 Advanced microprocessors & microcontrollers

Course Objectives

- To train the students with assembly language programming and hardware design using microprocessors and microcontrollers.

List of Exercises/ Experiments

I. 8051 - based experiments

1. Familiarization with 8051 based kit, peripherals, cross assembler/ cross compiler
2. Programming examples of arithmetic operations/ logical operations/ bit manipulation/ Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array. (At least 8 examples altogether)
3. Examples of interfacing 8051 with stepper motor/ DAC/ ADC/ Displays/ 8255/ 8253/ 8279/ 8251 (At least 2).

II. 8086 - based experiments

4. Familiarization of a typical 8086 microprocessor trainer kit and its operations
5. Introduction to DEBUG program commands
   - Examining and modifying the contents of the memory
   - Assembling 8086 instructions with the ASSEMBLER commands
   - Executing 8086 instructions and programs with the Trace and GO Command.
   - Debugging a program
6. Assembly language program development using IBM/PC Macro assembler
   - Creating an Assembler source file
   - Assembling source program
   - The link program - creating a RUN module
7. Programming examples of Arithmetic operations/ logical operations/ sorting and searching/ string manipulation operations/ code conversion/ digital clock and stop watch etc. (At least 8 examples altogether).
8. Examples of interfacing 8086 with stepper motor/DAC/ADC/Display/ 8255/ 8253/ 8279/ 8251 (At least 2).

Note: The experiments should cover both 8051 & 8086.

Expected Outcome

- At the end of the course students shall be able to design and implement microprocessor and microcontroller based systems.

Text Books:

Embedded Systems using Assembly and C, Pearson Education, 2e.

1. Lyla B. Das, The x86 Microprocessors: Architecture, programming and Interfacing (8086 to Pentium), Pearson Education, 2010, ISBN 978-81-317-3246-5.
2. Muhammed Ali Mazidi and Janice Gillispie Mazidi, The 8051 Microcontroller and