REGULATIONS, SCHEME AND SYLLABUS

FOR THE DEGREE OF

MASTER OF SCIENCE

(BIOMEDICAL INSTRUMENTATION)

OBJECTIVES OF THE COURSE

After the completion of the course, the candidate should be able to:

1. Handle the Biomedical Equipments at all levels used in Health care systems, from simple electronic design to highly sophisticated computerized equipments.
2. Supervise the operation and service of the equipments used in Medical field.
3. Guide specialists in various diagnostic and therapeutic procedures by acquiring sound knowledge of the functioning of Human body.
4. To undertake teaching and research in the Biomedical Engineering field.

NAME OF THE POST GRADUATE PROGRAMME

The name of the Master Degree programme shall be **"Master of Science (Biomedical Instrumentation)"**shall be abbreviated as **M.Sc (BMI).**

Candidates for admission to the First semester of the Master of Science in Biomedical Instrumentation Degree programme shall be required to have passed the Bachelor degree examinations with **Electronics, Instrumentation, Computer Science, Computer Application, Physics or Mathematics**as **main or subsidary** from any of the **University in Kerala or Universities recognized by Mahatma Gandhi University** as equivalent there to are eligible to apply for the course provided they have secured minimum of 50% marks for the optional subjects with usual relaxations allowed for Scheduled Castes, Scheduled Tribes and other Backward Classes. A weightage of 20% marks of the total score will be given to the students with B.Sc. Electronics/ B.Sc. Instrumentation Degree while calculating the merit marks for admission to the course.

DURATION AND STRUCTURE OF P.G. PROGRAMME

The duration of the course shall be **two years**, consisting of **4 semesters** with University examinations at the end of each semester.

The P.G. programme will consist of

(i) Core subjects
(ii) Practicals / Laboratory work
(iii) Project work
(iv) Seminars
(v) Hospital/Industry training as specified in the curriculum.

The Medium of Instruction, Examination, Seminar and Project reports will be in **English**.

The **Hospital/IndustryTraining** specified in the curriculum shall be of **10 daysduration** at the end of **first semester,15 days at the end of second semester** and **one month duration**at the end of **third semester** of the course.

A candidate may however in certain cases be permitted to work on the **Project** in an Industry/ Hospital/ Research Organization on the recommendation of the Head of the Department/ Director. In such cases the project work shall be supervised jointly by a member of the Department of Biomedical Instrumentation Teaching faculty and an Engineer / Scientist from that organisation.

ASSESSMENT PROCEDURE – EXAMINATIONS AND INTERNALS

I. UNIVERSITY EXAMINATIONS

There shall be one end semester examination of 3 hours duration in each **core subject**, conducted by University.

In case of **practicals**, an end semester Examination will be conducted by the University.

A **Viva-Voce** examination will be conduction by the University at the end of Final (4^{th})semester.

II. SESSIONAL EXAMINATIONS

In each **core subject**, the SessionalExaminations may be a combination of Attendance, Periodical tests, Assignments and Seminars conducted internally by the Department.

In case of **practicals/Laboratory work**,SessionalExaminations are a combination of Attendance, Performance and Examinations conducted internallyby the corresponding Department.

The **Seminar/ Project work** will be evaluated based on the Report, Presentation and Viva-Voce Examinations conductedinternally.

At the end of each **Hospital/IndustryTraining** the candidate shall submit a Training Report along with certificate from the Organization where he / she have undergone training. The evaluation will be based on the Attendance, Training Report, Presentation andViva-Voce Examination conducted internally. If a student is not securing separate minimum for Sessional examination, he /she shall be given a single redo chance before the commencement of the university examination provided he/she is having the minimum required attendance and the criteria for determining the Sessional assessment remaining the same.

MINIMUM REQUIREMENT FOR SUCCESSFUL COMPLETION

I. PASS MARK

The curriculum should be drawn up that the minimum pass marks for successful completion of M.Sc. (BMI) satisfy the following:

	University examinations		Sessional examinations		Total	
	Minim.	Max.	Minim.	Max.	Minim.	Max.
Core Subject	45	100	20	50	75	150
Practical/Laboratory Work	45	100	20	50	75	150
Viva –Voce	75	150	-	-	75	150
Subject-Sessional (BMI-105)	-	-	25	50	25	50
Practical(BMI-3P2)	-	-	50	100	50	100
SeminarI&II	-	-	25	50	25	50
Seminar III			50	100	50	100
Hospital Training (BMI-IP3,2P4)	-	-	25	50	25	50
Hospital Training (BMI-3P4)	-	-	50	100	50	100
Project Work (BMI-4P3)	-	-	75	150	75	150

II. ATTENDANCE

A candidate who has attendance less than **80%** will not be permitted to sit for the End Semester Examination in the subject / Laboratory work in which the short fall exists.

CLASSIFICATION FOR THE AWARD OF MASTER OF SCIENCE (BIOMEDICAL INSTRUMENTATION)

i) A candidate who completes the programme of study and secures a minimum pass mark in all subjects as specified will be declared to be qualified for the award of degree.

ii) A candidate who secures not less than **60%** of Marks in the aggregate of all examinations in four semesters will be classified to have passed in **First class**.

iii) A candidate who secures not less than **75%** of Marks in the aggregate in all four semesters will be declared to have passed in **First class with Distinction**.

iv) A candidate who secures **50%** marks or above, but below **60%** of marks in aggregate of all examinations in four semesters will be classified to have passed in **Second Class**

POWER TO MODIFY

Not with standing all that have been stated above the academic council has the right to modify any of the regulations from time to time.

SCHEME OF EXAMINATION

Subject Code	Subject	Marks: University Exams	Marks: Sessional Exams	Hours/ week
SEMESTER – I				
BMI - 101	Engineering Mathematics	100	50	6
BMI - 102	Introduction toAnatomy, Physiology and Biomedical Instrumentation	100	50	6
BMI - 103	Electrical Technology	100	50	7
BMI - 104	Electronic Devices & Circuits	100	50	7
BMI - 105	Communication and Soft Skills Development	50	3	
BMI - 1P1	Electronic Circuit Laboratory	100	50	3
BMI - IP2	Computer Applications Laboratory-I	100	50	3
BMI-1P3	Hospital/Industry Training	50	10 Days	
SEMESTER – II				
BMI - 201	Biomedical Equipments– I	100	50	7
BMI - 202	Digital Electronics and Integrated Circuits	100	50	7
BMI -203	Object Oriented Programming	100	50	7
BMI -204	Biophotonics and Non-Radiating Medical ImagingTechniques	100	50	7
BMI -2P1	Digital and Analog Circuits Laboratory	100	50	3
BMI- 2P2	Computer Applications Laboratory -II	100	50	3
BMI- 2P3	Seminar - I		50	1
BMI-2P4	Hospital/Industry Training		50	15 Days

SEMESTER – III

BMI - 301	Biomedical Equipments– II	100		50	7
BMI - 302	Medical Imaging Systems Using IonizingRadiations	100		50	7
BMI - 303	Biosensors and Medical Image Processing	100		50	7
BMI - 304	Microprocessor Based System Design	100		50	7
BMI - 3P1	Microprocessor Laboratory	100		50	3
BMI- 3P2	Biomedical Instrumentation Laboratory		100	3	
BMI- 3P3	Seminar - II			50	1
BMI- 3P4	Hospital/Industry Training	100	One Month		

SEMESTER – IV

BMI-401	Biosignal Processing	100	50	8
BMI-402	Medical Informatics	100	50	8
BMI- 403	Automation and Quality Control in Biomedical Engineering	100	50	8
BMI - 404	Hospital Management Science	100	50	6
BMI- 4P1	Viva-Voce	150		
BMI - 4P2	Seminar- III		100	2
BMI- 4P3	Project Work		150	3

SYLLABUS

SEMESTER –I

BMI-101 Engineering Mathematics

BMI–102 Introduction to Anatomy, Physiology and Biomedical Instrumentation

BMI-103 Electrical Technology

BMI-104 Electronic Devices & Circuits

BMI - 105 Communication and Soft Skills Development

BMI-1P1 Electronic Circuit Laboratory

BMI-1P2 Computer Applications Laboratory- I

BMI – 1P3 Hospital/Industry Training

SEMESTER –II

BMI-201 Biomedical Equipments– I

BMI-202 Digital Electronics and Integrated Circuits

BMI-203 Object Oriented Programming

BMI-204 Biophotonics and Non-Radiating Medical Imaging Techniques

BMI-2P1 Digital and Analog Circuits Laboratory

BMI-2P2 Computer Applications Laboratory II

BMI-2P3 Seminar-I

BMI – 2P4 Hospital/Industry Training

SEMESTER –III

BMI-301 Biomedical Equipments– II

BMI-302 Medical Imaging Systems Using Ionizing Radiations

BMI-303 Biosensors and Medical Image Processing

BMI-304 Microprocessor Based System Design

BMI-3PI Microprocessor Laboratory

BMI-3P2 Biomedical Instrumentation Laboratory

BMI-3P3 Seminar-II

BMI – 3P4 Hospital/Industry Training

SEMESTER –IV

BMI-401 Biosignal Processing

BMI-402 Medical Informatics

BMI- 403 Automation and Quality Control in Biomedical Engineering

BMI–404 Hospital Management Science

BMI-4P1 Viva-Voce

BMI- 4P2 Seminar-III

BMI- 4P3 Project Work

BMI – 101 ENGINEERING MATHEMATICS

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper enables the student to get an idea about different transformations in the Engineering field and the details of Probability and Statistics. It also includes Linear Programming.

MODULE – I

Laplace Transforms: Laplace Transforms, Properties, Inverse Transform, Laplace Transforms of Derivatives and Integrals, Convolution theorem,Transformsof unit step function and unit impulse function, Transforms of periodicfunction.

MODULE – II

Fourier SeriesAnd Integrals And Special Functions: Fourier series, Even and odd functions, Half range series, Harmonic analysis, Integral transforms, Fourier Sine and cosine integrals, Beta and Gamma functions and their applications.

MODULE – III

Fourier Transform: Infinite Fourier transform, Properties, Finite Fourier transform, Sine and cosine transform, Convolution theorem,parsevals identity.

Basics of Z transform and region of convergence, inverse Z transform, discrete Fourier transform and inverse and conformal mapping.

MODULE – IV

Probability and Statistics: Measures of central tendency – Mean, Median and Mode, Measures of dispersion, Correlation, Regression.Theory of Probability,Probability distribution, Binomial distribution, Poisson distribution,Normal Distribution, Tests of hypothesis.

MODULE – V

Linear Programming: Mathematical Formulation of LPPgraphical solution, Simplex method,Duality concept.

Transportation problem, Assignment problem, Mathematical Formulation, Unbalanced Assignment problem.

Reference :

1. ***"Higher Engineering Mathematics",***Dr.B.S. Grewal, Khanna publishers, 41st Edition, 2011.
2. ***"A Textbook of Engineering Mathematics",*** N.P.Bali & Dr.Manish Goyal, Laxmi publishers Ltd, 8th Edition, 2011.
3. ***"Advanced Engineering Mathematics",***M.C. Potter&J.L. Goldberg,Oxford university press.
4. ***"Advanced Engineering Mathematics",*** R.K. Jain, S.R.K Iyengar,Narosa publishers, 1991.
5. ***"Advanced Engineering Mathematics",***C.R. Wilie & L.C. Barrett,MGH Co.

University Examination Question pattern:

12 questions of 10 marks from module Ito module V with choice to answer any ten.

BMI – 102 INTRODUCTION TO ANATOMY, PHYSIOLOGYAND BIOMEDICALINSTRUMENTATION

Part A (*Introduction to *Anatomy) and Part B (*Introduction to *Physiology*) *are able to give general awareness of overall structure and function of systems (detailed study not required). The objective of the course is to understand the different parts of the body in relation with various Biomedical Equipments.

PART-A INTRODUCTION TOANATOMY

30Hours

Structure of heart, Structure of lungs,Structure of Cerebrum, Cerebellum, Hypothalamus.

Structure of Stomach, Small Intestine, Large Intestine, liver, Structure of kidney, Urinary bladder, Structure of Pancreas, thyroid and parathyroid glands, Structure of ovary and testis.

Basics on cell,Chromosomes,DNA,Genes,Chromosomal abnormalities.

PART-B INTRODUCTION TOPHYSIOLOGY

30Hours

Respiratory System: Transport of gases, Regulation of breathing, hypoxia.

Digestive system: Functions of stomach, pancreas, liver. Composition of digestive fluids, peristaltic movement.

Circulatory system: Blood, composition and functions of blood cells (RBC, WBC and platelets). Function ofheart– capillary and coronary circulation, Hormonal and long term regulation of BP.

Nervous system: Functions of Cerebrum, Cerebellum and Hypothalamus, Functions of Autonomous Nervous System(Sympathetic& Parasympathetic).

Excretory system: Physiology of urine formation,

Reproductive system: Function of ovary and testis.

Endocrine system: Hormone synthesis and functions.

PART-CINTRODUCTION TOBIOMEDICAL INSTRUMENTATION

60 Hours

This course will enable the students to learn the basic principles of the physiological signals. Also, it gives an overview of basic measuring instruments and amplifiers used in medical field.

MODULE – I Define BMI,Careers in BMI,Job responsibilities.

Bioelectricity: Excitable cells, Nernst potential, Resting membrane potential, Polarized state, Action potential, de-polarization, re-polarization, Propagation of nerve impulses, Refractory period – absolute and relative,Modes of transport of substances across the cell membranes.

MODULE – II

Electrocardiogram: Electrical activity of the heart–Cardiac muscle, Action potentials in cardiac muscle, SA node, Origin and propagation of rhythmical excitation & contraction, regular and ectopic pacemakers, ECG waveforms and their significance, Arrhythmias– abnormal rhythms, heart blocks, premature contractions, flutter, fibrillation, vulnerable period.**Electroencephalogram:**Electrical activity of brain –Waveforms – Different stages.**Electromyogram:**Electrical activity of muscles –neuromuscular junction, synaptic potentials, artifacts,motor unit action potentials–nerve conduction studies– NCV.

MODULE – III

Electrodesfor measurement of biopotentials: Electrode-tissue interfaces, electrode-electrolyte and electrolyte-skin interfaces, Skin contact impedance, Electrodes for ECG, EEG, EMG.

Basic measuring instruments: Multimeters – analog and digital multimeters. Frequency and time measurement – analog CRO and digital storage oscilloscope. Medical display systems – single and multichannel displays, nonfade displays, LED and LCD displays.

Writing systems: Different types of recorders.

Preamplification: Difference amplifiers, Chopper amplifiers, Carrier amplifiers, Instrumentation amplifiers, Isolation amplifiers.

Reference:

1. ***"Textbook of Human Anatomy",***S.Chand & Co.Ltd, 1996.
2. ***"Textbook of Medical Physiology",*** Arthur C. Guyton, Prism Book (P) Ltd, 1996.
3. ***"Handbook of Biomedical Instrumentation",***R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
4. ***"Elements of Electronic Instrumentation and measurement",***Joseph J Carr, Pearson Education, Third Edition.

University Examination Question pattern: (Part A,Part B &Part C in separate main sheet)

Part A (Introduction to Anatomy) Max marks: 25 marks

6 questions of 5 marks with choice to answer any five.

Part B(Introduction to Physiology)Max marks: 25 marks

6 short type questions of 5 marks from module II with choice to answer any five.

Part C(Introduction to Biomedical instrumentation) Max marks: 50marks

I - 4 questions of 10 marks from module III to module V with choice to answer any three.

II - 5 questions of 5 marks from module III to module V with choice to answer any four.

BMI – 103 ELECTRICAL TECHNOLOGY

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

The objective of this paper is to understand the electrical circuits and theorems in the Biomedical field. Also, it enables the students to get an idea about the basic electrical equipments.

MODULE – I

DC Circuits: Kirchoff's Laws, Node and Mesh analysis, Voltage and Current source transformations, Star and Delta transformations,Superposition, Thevenin, Norton, Maximum power transfer, Tellegan, reciprocity and Compensation theorems.

MODULE – II

AC Circuits: Series and parallel AC circuit, RL – RC and RLC circuits, phasor diagram, Active power, Reactive power and apparent power,Series and parallel resonance circuits, Bandwidth and selectivity of resonant circuits.

Coupled circuits and coefficient of coupling, Self and Mutual Inductances.

MODULE – III

Three Phase Circuits: Three Phase Circuits, Balanced circuits, Star and Delta connected loads, Unbalanced circuits, Solution of Unbalanced Star and Delta connected loads, Power measurements by two Watt meters method.

Transformers: Transformer theory, current and voltage relations in primary and secondary windings, e. m. f. equations, Vector diagrams,Losses and efficiency, Open circuit and short circuit tests, Regulations– 3 Phase transformers– Auto transformers.

MODULE – IV

DC Machines: DC Generators–Shunt, Series and compound generators, EMF equation, Losses and efficiency, Commutation, Armature reactions, Characteristic curves, DC Motors, Back emf, Torque equation, Losses and efficiency; Characteristic curves, shunt, series and compound Motors, speed control of DC motors and Starters.

MODULE – V

AC Machines: Ac Generators, Rotor and stator windings, emf equations, Frequency, Synchronous speed, Losses and efficiency.

Synchronous motors, Vector diagram for varying excitations, V Curves.

Induction Motor–Basic principle, Squrriel and slip ring motors–synchronous speed, slip, Torque Characteristics, losses and Efficiency, Star delta starter, Types of Single phase Induction Motors–Universal Motors.

MODULE – VI

Special Machines and Measuring Instruments: Tacho generators, AC and DC servo motor, stepper motor, Linear Induction Motor,Relays and Contractors, Circuit Breakers – MCBs and ELCBs, Current and Potential Transformers, Protective systems – Fuses –Isolators and switches,Earthing, Surge protectors.

Analog Ammeters, Voltmeters, Multimeters, Wattmeter, Energy meter, Megger. Extension of ranges. Voltage stabilizers and UPS (Offline and Online).

Reference:

1. ***"ElectricCircuits&Electronic Devices",*** A.Milton, S.Caroline.
2. ***"Industrial Instrumentation",*** W.Prabhakararao.
3. ***"Textbook of Electrical Technology in S.I. system of units: volume 2: AC and DC machines",*** B.L. Theraja, S. Chand & Company Ltd, 1997.
4. ***"Electrical Technology",***Edward Hughes, Addison Wesley Publication.
5. ***"Electrical Machines",***Nagarath & Kothari,Tata Mc Graw Hill, 1999.

University Examination Question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B- 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI -104 ELECTRONIC DEVICES& CIRCUITS

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper introduces an idea about basic electronic devices which include passive and active devices. It also helps to understand the basic electronic circuits such as wave shaping circuits, wave generating circuits,etc…

MODULE -I

Junction Diodes: VI characteristics of Diodes, Rectifiers – Expression for ripple factor and efficiency. Filters– capacitor, inductor, LC and CLC filters– Expression for ripple factor.Zener and avalanche diodes–Zener diode as voltage regulator.

Special Diodes: Principles and operation–Tunnel, PIN, Varactor, Photodiodes, LED, LVD, LDR and Thermistor.Thyristors– Classification & Constructional Details.

Transistors: Fundamentals of BJT operation, Transistor configurations, Current application factors –Relations between alpha & beta comparison. Field effect transistors –JFET,

MOSFET, General characteristics–enhancement and depletion modes. UJT, SCR, TRIAC and DIAC–Principles, Characteristics and Applications.

MODULE –II

Amplifier circuits: Biasing techniques of BJT, stabilization of operating point,concept of load lines, Analysis and design of BJT amplifier circuits in common emitter, common collector and common base configurations,Frequency response of RC coupled amplifier. FET and MOSFET amplifiers, Multistage amplifiers (RC coupled and Transformer coupled).

Negative feedback: Effect of negative feedback on amplifier performance, Voltage series, current series, Voltage shunt, feedback arrangements, design of feedback amplifiers, Darlington connection.

MODULE –III

Power amplifiers:class A, B, AB and C power amplifiers, efficiency, push-pull and complementary symmetry power amplifier –Harmonic distortion – Thermal runaway andHeat sinks.

MODULE – IV

Oscillators: Positive Feedback, Principle of Sinusoidal Oscillators, Barkhausen Criteria, RC Oscillator, Phase shift, Wien Bridge, LC Oscillators, Hartley, Colpitt's, Clapp Oscillator and Crystal Oscillator.

Multivibrators– Astable, Monostable and Bistable circuits using BJTs–Applications.

Pulse shaping using RC circuits –Differentiating and integrating circuits.Clipping and Clamping circuits using Diodes, voltage multipliers.

Reference:

1. ***"Electronic Devices & Circuit Theory",*** J.B.Gupta, Third Edition, S.K.Kataria & Sons, 2009.
2. ***"Electronic Devices & Circuit Theory",***Boylestead & Neshelsky, Prentice Hall of India, 2003.
3. ***"Electronic Devices & Circuits",***Allan Mottorshed, Prentice Hall of India, New Delhi, 2003.
4. ***"Electronic Devices & Circuits",***Theodore F. Bogart, Universal Book Stall, New Delhi, 1992.

University Examination Question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B - 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI – 105 COMMUNICATION AND SOFT SKILLS DEVELOPMENT

Sessional Examination: 50 Marks

Module I Communication

Communication in management process – effectiveness – Communication opportunities – Choice of media – Formal – Informal – Types – techniques.

Group communication –Methods – Problems – Solutions – Meetings

Speeches – Structure of speech – Drafting of speech – Speeches for different occasions,

Interview – Listening and observation skills – Body language.

Module II Reports

Report writing – Types of report – Structure – Methods of collecting and preparing material drafting of report

Business correspondence – Drafting of letters – Circulars – Answering letters.

Office orders – Office circulars – Office notes – Suggestions – Complaints – Office memorandums.

Meeting documentation – Notice of the meeting – Agenda – Chairman's speech – Recording meetings – Writing minutes – Minute book – Writing meeting reports – Assignment – Writing annual report

Module III Group Process lab:

Workshop – Seminar – Media and advertising lab Self development and assessment – Self assessment- self awareness – perception and attitudes – values and belief system – personal goal setting – career planning – self esteem – Building self confidence.

Planning, preparation, delivery, feedback and assessment of – public speaking, group discussion and oral presentations.

Module IV Time Management

Managing time, Improving personal memory – rapid reading, notes taking – complex problem solving – creativity.

Team Building, StressManagement, Setting skills.

Module V Career Skills

Curriculum Vitae and Cover Letters, Facing an interview, Presentation Skills, Persuasion Skills.**Module V Communication Lab Activities.**

Reference:

1. Dalmer Fisher: Communication in Organization's , Jaico Publishing Co., Bombay
2. Krishna Mohan & Meera Banerji, Developing Business Communication., Mc Millan Education Ltd.
3. Rajendra Pai & Bhatnagar OP: Education and Communication for department
4. Raymond V Lesikar John., D. Pettil Jr & Lakshman C Arya: Business Communication, All India Traveller Book Seller., New Delhi.
5. Essentials of Business Communication, Rajendra Pal, JS Korlahhi: Sultan Chand & Sons, New Delhi.
6. Basic Communication Skills for Technology, Andre J. Rutherford: Pearson Education Asia, patparganj, New Delhi 92
7. Advanced Communication Skills, V. Prasad, Atma Ram Publications, New Delhi.

BMI – 1P1 ELECTRONIC CIRCUIT LABORATORY

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

1. Familiarization of Electronic Components and Electrical Equipments.
2. Electric wiring, soldering, etc.
3. PCB Fabrication.
4. Characteristics of Active devices.
    i) Forward characteristics of a Diode
    ii) Forward and reverse characteristics of a ZenerDiode
    iii) Characteristics of a Transistor
    iv) Characteristics of an FET
5. Clipping and Clampingcircuits using Diodes.
6. Differentiating circuit and Integrating circuits.
7. Rectifying circuits.
    i) Half WaveRectifier
    ii) Full WaveRectifier
    iii) Full Wave Bridge Rectifier
    iv) Filter circuits - Capacitor filter, Inductor filter, LC filter and Pi section filter(Measurement of ripple factor)
8. Biasing of BJT.
9. Amplifiers.
10. Oscillators and Multivibrators.

BMI- 1P2 COMPUTERAPPLICATIONS LABORATORY

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

1. Computer fundamentals, Computer Organization, etc…
2. MS OFFICE
3. Programming in C.

Reference:

1. Kernighan et. al., “The C Programming Language”, Prentice Hall of India, Ltd.
2. Hutevhison. R., “Programming in C”, McGraw Hill, New York.
3. Gottfried. S. B., “Theory and Problem of Programming with C”, Tata McGraw Hill Pub

BMI- 1P3 HOSPITAL/INDUSTRY TRAINING

(Sessional Examination: 50 Marks)

The students should get tendaysin-plant training in a hospital/industry.The aim of the training is that the students get familiarized with the various Medical Equipments and the topics included in the syllabus. The students shall submit a report based on this training and present it.

BMI 201 BIOMEDICAL EQUIPMENTS– I

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This subject is to provide an overview of different Biomedical instruments and their classification. It emphasis the principles and operation of analytical and diagnostic instruments.

MODULE-I

Overview of Biomedical Instrumentation system – Types of biomedical equipments – Analytical, Diagnostic, Therapeuticand Surgical equipments – caliberation of medical devices and testing of biomedical equipments, Electrical classification of Biomedical Equipments

MODULE – II

Analytic Equipments: Flame photometers, Introduction to Spectro photometers,Beer lambert law,Colorimeters, Blood gas analyzers –Electrodes for pH, pO_2 and pCO_2.

Hb meter, Blood cell counters, Auto analyzers,Radio Immuno Assay and ELISA techniques. Principles and techniques of sterilization–Autoclave, Sterrad. Chromatography – Gas and liquid Chromatographs – Principle and applications.

Mass spectroscopy, flow cytometry–Principles and applications. Electrophoresis – Principles and applications.

MODULE – III

Diagnostic Equipments: Electrocardiography (ECG) –ECG in diagnosis –Lead systems – Artifacts –ECG Machine.

Principles and applications–Vector cardiography (VCG), Magnetocardiography (MCG) – SQUIDSand Phonocardiography (PCG).

Cardiac stress testing – bicycle and treadmill tests – protocols. Cardiac output measurement– different techniques.

Electro encephalography (EEG), EEG Machine, Artifacts, Evoked potentials – Visual, Auditory and Somatosensory EPs.

Principles and applications–Magneto encephalography (MEG), Electroretinography (ERG) and Electrooculography (EOG).

Principles and applications–Electromyography (EMG)–Electroneurography (ENG).

Principle of light conduction in Fibre optic cable –Endoscopy, Laparoscopy, Sigmoidoscopy, bronchoscope, colonoscopy.

Principles of thermography, Detecting circuits, its application in medicine.

MODULE – IV

Patient monitoring system–Bed-side monitors, Central station monitors, Computerized arrhythmia monitors, Cardio scope, Ambulatory monitors, Neonatal monitors,Holter monitoring, Infant Warmer, Neonatal Incubator, Infusion pump, syringe pump,Cardiotocograph – Methods of monitoring fetal heart rate.

Biotelemetry – Principles – Types – Single channel and Multichannel – Frequency division and Time division multiplexing, Telestimulation, Telemedicine – Principles and applications.

MODULE – V

Audiometers –Pure tone, Speech and Mask audiometers, Bekesy audiometers, Tympanometers. Hearing aids, Cochlear implants, Ear moulds.

Densitometers – Principle and applications.

Reference:

1. ***"Principles of Applied Biomedical Instrumentation",***L.A.Geddes & L.E.Baker, Wiley India Pvt.Ltd, Third Edition, 1989.
2. ***"Handbook of Biomedical Instrumentation",*** R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
3. ***"Handbook of Analytical Instruments",*** Khandpur R S, Tata McGraw Hill,1989
4. ***"Biomedical Instrumentation",***Shakthi Chatterjee & Aubert Miller, CENGAGE Learning, 2010.
5. ***"Handbook of Biomedical Instrumentation",***Chanderlekha Goswami, Manglam Publications, 2010.
6. ***"Medical Instrumentation: Application and Design",***John G.Webster, Wiley India Pvt.Ltd, Third Edition, 2002.
7. ***"The Biomedical Engineering Handbook",***Joseph D. Bronzino, CRC Press, 1995.
8. ***"Encyclopedia of Medical Devices and Instrumentation",***John G. Webster, Second Edition, Wiley Interscience, 2006.
9. ***"Principles of Biomedical Instrumentation and Measurements",***Richard Aston, Merril Publishing Co, 1990.
10. **"*Telemedicine: Medicine and Communication*",** Thorsten M Buzug, Heinz Handels, Dietrich Holz, Springer Verlag, 2001.

University Examination Question pattern:

Part A	- 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B	- 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 202 DIGITAL ELECTRONICS AND INTEGRATED CIRCUITS

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

The aim of the paper is to learn the basic digital circuits and their uses. This paper also enables the student to understand the circuits using op-amps which have wide applications in the field of medicine..

MODULE -I

Number System and Codes: Binary, Octal, and Hexa-decimal number systems, Binary coded Decimal, Excess - 3 code, Gray Code.Binary arithmetic and Complement of numbers, Addition and subtraction with BCD.

Boolean algebra –De-Morgan's Theorem.Minimization of Boolean function using Boolean Theorems, Karnaugh Map and Quine – McClusky methods. Realization of logic function using NAND, NOR.

Combinational Circuits: Multiplexer, Demultiplexer, Decoder, Decoder.

Arithmetic Circuits: Half adder, Full adder, Serial and parallel addition – Carry look ahead adder, Subtractor.

MODULE –II

Sequential Circuits: Flip-flops – RS, JK, JKMS, T & D flip-flops, Shift registers, Counters –Asynchronous and synchronous counters, Up-Down counter, Shift register counters, Decade counter, Ring counter, Johnson counter. Sequence generators –state tables and diagrams.

Logic Families:DCTL, RTL, DTL, TTL, ECL, CMOS, Tri-state logic – specification and transfer characteristics of basic TTL –Current and voltage parameters –Fan in and Fan out – Propagation delay, noise consideration, Comparison.

MODULE –III

Introduction to Operational Amplifiers: Basic differential amplifier –dual input balanced output and unbalanced output –Internal block schematic of op amp –Op-amp parameters–Slew rate, Input bias current, offset current, CMRR, SVRR, Unity gain bandwidth, Input and output impedance.Ideal characteristics of op amp–Open loop gain –frequency response.

Open loop and Closed loop Op-Amp Configurations: Feedback configurations – Voltage series feedback and voltage shunt feedback –concept of virtual ground –voltage follower.

Inverting and non-inverting amplifier, summer, subtractor, average, Integrator and differentiator, instrumentation amplifier, voltage to current and current voltage convertor, voltage to frequency convertor, clipper, clamper, Log and Antilog amplifiers. Sample and hold circuit, Precision rectifiers.

MODULE – IV

Comparator: Applications of comparator, Zero crossing detector, Regenerativecomparators (Schmitt trigger).

Multivibrators: Astable and monostable –Design, working.

Wave generators: Triangular and saw tooth, RC phase shift and Wien bridge oscillators.ADC– successive approximation, flash, integrating. DAC –weighted, R-2R.

MODULE – V

Active Filters: Transfer functions– LPF, HPF, BPF, and BRF. Approximation methods – Butter worth – Chebyshev Filters – I order and II order filters–All Pass filters –Quality factor.

Specialized ICs and applications: IC regulators –723 (block diagram, typical low voltage regulator circuit). Timers –555 – Functional block diagram–Astable and monostable multivibrators using 555 –applications. Voltage Controlled Oscillators – 566. Phase locked loop (PLL) –Block diagram and derivation of capture range, lock range and pull in time capture and lock range –565 – applications.

Reference:

1. ***"Digital Fundamentals",***Floyd & Jain, Pearson Education, 8th Edition.
2. ***"Digital Principles and Applications",*** Malvino and Leach, Mc Graw Hill, 5th Edition.
3. ***"Fundamentals of Logic Design",***Charles H.Roth, Thomson Learning, 5th Edition.
4. ***"Op-Amp and Linear Integrated Circuits",*** Ramakant A. Gayakwad, Pearson Education Asia,4th Edition.
5. ***"Op-Amps and Linear Integrated circuits",***Coughlin & Driscoll, Pearson Education Asia, 2000.

University Examination Question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B - 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 203 OBJECT ORIENTED PROGRAMMING

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper is designed to understand the basic object oriented programming languages. It emphasis C++ programming language with programming examples.

MODULE-I

Object oriented programming principles, Definition and motivation of object oriented programming languages, Features of object oriented programming languages- data abstraction, encapsulation, classes and objects, genericity, inheritance, polymorphism and dynamic binding, garbage collection, exception handling.

MODULE –II

The C++ programming language– History, data types, expression, statements,operators. The class- member variables and functions, scope of class members-program level, file level and local. Objects and initialization,pointer to class members,class argument and ellipsis.Functions-function prototypes and strong type checking, argument passing, returning a value,constructors and destructors, pointers to functions.

MODULE –III

Polymorphism- function overloading, operator overloading, virtual functions. Abstract class. Friend class and friend functions. Inheritance– single, multilevel, multiple, hierarchical, and hybrid inheritances. Conversion operators– derivation Vs composition information hiding, class scope and standard conversion, virtual function, Dynamic memory management- new and delete,Dynamic binding.

MODULE- IV

Miscellaneous features–Union, bit field, type safe linkage, C++ Vs C, programs in C++.

Reference:

1. Lafore.R., "Object oriented programming in Microsoft C++", Galgotia, New Delhi.
2. Venugopal, Ravishanker and Rajkumar, "Mastering C++", Tata McGraw-Hill.
3. D. Ravichandran, "Programming with C++", Tata McGraw-Hill.
4. Appleby, "Programming Languages: Pradigm and Practice", Tata McGraw-Hill, First edition.
5. N.E.Smith, "Object oriented programming using Turbo C++", BPB, New Delhi.
6. Sourav Sahay: *Object Oriented Programming with C++*, Oxford University Press, 2006
7. The C++ Programming Language, Pearson (2008),Bjarne Stroustrup
8. Object Oriented Programming With C++ 5th Edition

University Examination Question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B - 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 204 BIOPHOTONICS AND NON-RADIATINGMEDICAL IMAGING TECHNIQUES

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

The objective of this paper is to understand the uses of laser in medical field and holographic imaging techniques. Also, it helps to learn the principles and applications of ultrasound.The principles and applications of MRI are also included in this paper.

MODULE –I

Laser: Laser physics, Characteristics of laser radiation– Coherence of light, Principles of laser action – Population inversion – Optical pumping – Metastable states – Conditions for laser action, Different types of lasers and its applications – Solid, Liquid and Semiconductor lasers, Applications of Laser in Biology– Dentistry, Dermatology, Medicine, Surgery, Angioplasty and Endoscopy, Laser safety management, Personnel safety.

MODULE –II

Holography: Introduction, Recording and Reconstruction of holograms, Holographic Recording media, Holographic memory, Holographic Interferometry, Motion induced contrast images, Holographic computer,Holographic application in medicine, Correlation filtering, Fourier optics.

MODULE –III

Medical ultrasound: Physics of ultrasonic waves, Interactions with body matter, Generation and detection, Single element transducer construction, Linear and sector scanning Transducer arrays, Different modes of display, Modes of transmission of ultrasound, Colour Doppler, Ultrasonic diagnosis in Abdomen, Breast, Heart, Chest, Eye, Kidney, Skull, Pulsatile motion, Pregnant and Non-Pregnant uterus.

Ultrasound pulse echo imaging system, Design of scan converters,Design of frame grabbers, 2D scanners.

MODULE –IV

Magnetic Resonance Imaging: Principles of image formation– MRI instrumentation – magnets – Gradient system – RF coils receiver system,Pulse sequence– Image acquisition and reconstruction techniques, Application of MRI,NMR Spectroscopy.

Reference :

1. ***"Lasers in Medicine",***Leon Goldman, Springer-Verlag.
2. ***"Introduction to Biomedical Photonics",***Paras N.Prasad,John Wiley.2003.
3. ***"The Physics of Diagnostic Ultrasound",*** Peter Fish, John Wiley &Sons, England, 1990.
4. ***"Ultrasound Physics & Instrumentation",***D.L. Hykes, W.R. Hedrick &D.E. Starchman, Churchill Livingstone, Melbourne, 1985.
5. ***"The Physics of Medical Imaging",*** S. Webb, IOP Publishing Ltd., 1988.

University Examination Question pattern:

Part A	- 6 questions of 10 marks from module Ito module IV with choice to answer any five.
Part B	- 12 questions of 5 marks from module Ito module IV with choice to answer any ten.

BMI- 2PI DIGITAL AND ANALOG CIRCUITS LABORATORY

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

1. Study of Logic circuits –AND, OR, NOT, NAND, EX-OR, etc.
2. Design of half adder and full adder using NAND and NOR gates.
3. Design of half subtractor and full subtractor using NAND and NOR gates.
4. Set up RS, T, D, JK & JKMS flip flops using NAND Gates.
5. Sequential Logic circuits, Counters, Registers etc.,
6. Study of IC counters.
7. Study of op amps and basic circuits using op amp.

   (Comparator circuits, arithmetic circuits, simple amplifier circuits)
8. First order and second order high pass and low pass filters.
9. Precision rectifiers (Half wave and Full wave).
10. Band pass filter 11. Bioamplifier 12.Digital to analog converter
13. Phase detector 14. Sample and Hold circuit
14. Study of 555 IC and its applications (Astable and Monostable Multivibrators).

BMI- 2P2 COMPUTER APPLICATIONS LABORATORY-II

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

1. Programs in C++.

BMI -2P3 SEMINAR-I

Sessional: 50 Marks

The Seminar to be presented shall include any topic of current areas of Bio-Medical Instrumentation coupled with clinical practice. The Seminar shall be carried out under the supervision of Faculty Member in the Department. Students shall individually prepare and submit a seminar report. Each student shall present a seminar for about 15 minutes duration on the selected topic. The report and presentation shall be evaluated based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

BMI- 2P4 HOSPITAL/INDUSTRY TRAINING

SessionalExamination:50Marks

The students should getfifteen days in-plant training in a hospital/industry.The aim of the training is that the students get familiarized with the various Medical Equipments and the topics included in the syllabus. The students shall submit a report based on this training and present it.

BMI 301 BIOMEDICAL EQUIPMENTS– II

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper will enable the students to learn the principle and operation of Therapeutic and Surgical instruments. Also, it gives an idea of Hospital gas supply system and details about electrical safety. Recent advances in Biomedical field also summarizes in this paper.

MODULE-I

Cardiac pacemakers: Classification –External and internal (implantable) pacemakers,Synchronous and asynchronouspacemakers, programmable pacemakers, power sources, Pacing system analyzers.

Cardiac defibrillators: Classification–AC and DC defibrillators, Biphasic and Monophasic, Basic principles and comparison of output waveforms of different DC defibrillators, Energy requirements,Synchronous, manual and asynchronous operation, implantable defibrillators, defibrillatoranalyzers, AED.

MODULE –II

Respiratory Equipments: Ventilators–Generations–Parameters-Modes of operations-Pressure, Flow, volume, cycling, Ventilator terms – ventilator types– Jet ventilators,Humidifier, Nebulizer, Spirometry, Nitric Oxide Therapy,PFT,Plethysmography,Oxymetry –Transmission and Reflection Oxymetry, Finger tip Pulse Oxymeter.

Instrumentation in Extracorporeal Circulation and Cardiac Assist Devices: Dialysis Machine–Peritoneal and Haemodialysis – Dialyzers,Artificial lung– Oxygenators, ECMO,Artificial heart, Intra Aortic Balloon Pump (IABP), Heart Lung machine, Lithotripsy– Principles of Percutaneous, Ultrasonic & Extracorporeal Shock Wave Lithotripters (ESWL).

MODULE –III

Physiotherapy Equipments: Diathermy –Microwave diathermy, Shortwave diathermy,Ultrasonic diathermy, Ultrasonic stimulators, Electrotherapy, TENS, IFT, Ultrasonic nebuliser.

Cryogenics: Principles of cryogenic techniques, Application of cryogenics in medical field.

MODULE –IV

Operation theater equipments: Surgical Light, Operating Table, C Arm, Craniotomy,ElectrosurgicalMachines (ESU),Electrosurgical analyzers,Surgical aspirator,Anesthesia machine, Anesthesia gas,Anesthesia gas monitor, Surgical microscope.

MODULE –V

Hospital Gas supply system: Centralized supply of air, Oxygen,Nitrogen, Nitrous oxide, CO_2, Vacuum, Principle andProduction of liquid Oxygen.

Electrical safety: Types of Shock hazards –Micro and macro shock–Circuits for protection from electrical hazards – Ground fault circuit interrupter and Isolation transformer.

PACS, DICOM, Introduction to Nanotechnology.

Reference :

1. ***"Principles of Applied Biomedical Instrumentation",***L.A.Geddes &L.E.Baker, Wiley India Pvt.Ltd, Third Edition,1989.
2. ***"Handbook of Biomedical Instrumentation",***R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
3. ***"Biomedical Instrumentation",***Shakthi Chatterjee& Aubert Miller, CENGAGE Learning, 2010.
4. ***"Handbook of Biomedical Instrumentation",***Chanderlekha Goswami, Manglam Publications, 2010.
5. ***"Medical Instrumentation: Application and Design",***John G.Webster, Wiley India Pvt.Ltd, Third Edition, 2002.
6. ***"CRC Handbook of Clinical Engineering",*** B. N. Feinberg, CRC Press, 1980.
7. ***"The Biomedical Engineering Handbook",***Joseph D. Bronzino, CRC Press, 1995.
8. ***"Nanotechnology: A Gentle Introduction to the NextBig Idea",***Mark A Ratner, Daniel Ratner, PHI.

University Examination Question pattern:

Part A	- 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B	- 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 302MEDICAL IMAGING SYSTEMS USING IONIZING RADIATIONS

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

The objective of this paper is to understand the underlying physics of the medical imaging systems and to give an overview of major modern diagnostic imaging technologies. Also, it supports more in depth investigations into radiography and nuclear medicine imaging modalities.

MODULE –I

X-rays: Principle and production of X-rays,Bremsstrahlung radiation, Interaction of X-rays with matters, Transfer characteristics of screen, Film and image intensifier systems, Properties of X-ray films and screens,Characteristics of Imaging system by image modulation transfer functions,Characteristics of high fidelity television chains.

Radiography: Various components of Radiography systems – Exposure switching and control of exposure time – Types of timer circuits, Filament circuit and KV– mA controls – HT units – X-ray tubes for various medical applications – fixed anode, rotating anode, x-ray tubes for specialized applications – collimators – grids, X-Ray processing methods-Manual, CR and DR,Mamography. Cath Lab Description

MODULE –II

Fluoroscopy systems – characteristic of image intensifying television for fluoroscopy – TV systems – Fundamentals, monochrome colour – scanning principles, Basics of digital radiography, Charge coupled devices.Basics of digital angiography –Digital subtraction angiographic techniques.

Module –III

CT principles – Principles of sectional imaging, generations – CT image formation, conversion of X-ray data into scan image – mathematical details of various algorithms– Principles of 3D imaging.Types of CT scanners – spiral CT, multi slice CT.

Radiation safety – safety precautions – Hazardous effects of radiation– Allowed level protection methods.

MODULE –IV

Nuclear Medicine–Physics of radio isotope imaging– Radioisotopes in medical use – Radionuclide production –Cyclotron –Radiopharmaceuticals– Radiation Detectors – Scintillation Detector – Photomultiplier Tube – Pulse Height Analyzer –Rectilinear scanners–Gamma camera – Emission computed tomography –PET scanner– SPECT– Linear accelerator – Construction, Operation and Applications – Betatron, Cobalt and Caesium therapy –Automatic treatment planning.

Reference :

1. ***"Fundamental Physics of radiology",*** W.J. Meredith & J.B. Massey, Varghese Publishing House, Bombay, 1992.
2. ***"A Manual of Radiographic Equipments",*** Sybil M.Stockley, Churchill Livingstone, New York, 1986.
3. ***"Radiographic Imaging",*** D.N. & M.O. Chesney, CBS Publishers, 1990.
4. ***"The Physics of Medical Imaging",*** S. Webb, IOP Publishing Ltd., 1988.

University Examination Question pattern:

Part A	- 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B	- 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 303 BIOSENSORS AND MEDICAL IMAGE PROCESSING

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper introduces an idea about various biological sensors present in human body. It also provides an overview of different transducers and biosensors in Medical field and also introduces the applications of BioMEMs. This paper also helps to understand the techniques of image processing.

MODULE – I

Study of biological sensors in human: Classification of various receptors –Mechanical receptors – touch, pressure and pain receptors, tactile receptors, taste receptors, sensors for smell, receptors of sound – Mechanism of hearing, receptors of vision – Mechanism of sight – Functions of rods and cones. Baro receptors in aorta – J receptor in the lungs –Osmolality.

MODULE – II

Transducers: Active/Passive**,**Temperature transducers– thermo resistive, thermoelectric, pn junction, chemical thermometry. Displacement transducers –resistive– strain gauges, inductive, capacitive displacement transducers. Pressure transducers –Direct methods andindirect methods –Measurement of blood pressure using Sphygmomanometer – Instrument based on Korotkoff sound, strain gauge and LVDT transducers, capacitive and piezo electric type, catheter tip transducers – measurement of intracranial pressure –implantable type. Transducers for velocity and torque measurements.

MODULE – III

Biosensors: Ion sensors –Anion and cation sensors,Membrane electrodes, Enzyme electrodes–Biocatalyst based biosensors –ISFET for glucose, urea etc.Fibre optic sensors,Photo voltaic transducers, Photo acoustic sensorsand Radiation thermometry.

Data acquisition and recording: Signal conditioners, Single and multichannel data acquisition systems, Data transmission systems, Multicolour dot scanner.

MODULE – IV

Introduction to Microsystems: MEMS and BioMEMs,MEMS materials, MEMS Devices, Applicationsin medical field –BioMEMs as a biosensor, BioMEMs for Diagnosis, BioMEMs in Medical implants and surgery.

MODULE – V

Medical Image Processing: Image processing fundamentals –Image enhancement – Point operation, Histogram manipulation, histogram equalization, modification. Image filtering restoration and denoising –Inverse and Weiner filters. Image Segmentation, Image compression, Image analysis– spatial feature extraction, Edge detection, image segmentation, Colour image analysis.

Reference :

1. ***"Textbook of Medical Physiology",*** Arthur C. Guyton, Prism Book (P) Ltd, 1996.
2. ***"Essentials of Medical Physiology",*** Mahapathra.
3. ***"Sensors & Transducers",***Keith Brindley, Heinemann Newnes, Great Britain, 1988.
4. ***"Handbook of Biomedical Instrumentation",***R.S. Khandpur, Second Edition, Tata McGraw Hill, 2003.
5. ***"Fundamentals of BioMEMS and Medical Micro devices",***Steven S. Saliterman,SPIE PressMonograph, 2006.
6. ***"Fundamentals of Digital Image Processing",***Jain Anil K, Prentice Hall of India, 1989.

University Examination Question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B - 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 304 MICROPROCESSOR BASED SYSTEM DESIGN

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This subject is to provide an overview of microcomputers, microprocessors and memories. It includes the introduction and architecture of 8-bit and 16-bit microprocessors. It also includes the assembly language programming with 8085 microprocessor.

MODULE –I

Introduction to microprocessor: Microcomputers and microprocessors –Internal architecture of Intel 8085 microprocessor – Block diagram, Registers, Internal Bus Organization, Control signals, External Address / Data bus multiplexing, Demultiplexing, I/ O mapped I/ O, and memory mapped I/ O techniques, Architecture of Z-80. Introduction to micro controllers – comparison with microprocessors – Study of micro controller (MCS 51 family–8051) – Architecture.

MODULE –II

Assembly Language Programming: 8085 instruction set: Instructions, Classifications, Addressing modes, Stack and Subroutines, Delay routines, Counters etc. Programming examples.

Instruction Timing and Interrupts: Timing Diagrams (of various instructions): T-state, Machine cycle (Opcode fetch, Read / Write, Interrupt Acknowledge, etc), Interrupts: - types, Maskable / Non maskable, their organization.

Memories: Memory design: Semiconductor memories, RAM, ROM, EPROM, Programmable logic array, charge coupled devices content accessible memories, Magnetic cone/ drum/ disc memories, Magnetic bubble memories. Static and dynamic RAM devices, Concepts of popular memory chips, Design of typical memory capacity using standard chips, address decoding I/O addressing schemes, CD, ROM.

MODULE –III

Memory interface: Concept of memory chip/ chips interface to 8085 with appropriate examples.

Programmable interfacing devices: Programmable peripheral interface (Intel 8255), Programmable timer interface (Intel 8253/ 54), Programmable display / Keyboard interface (Intel 8279), Programmable serial communication interface (Intel 8251) –their inter face to 8085,DMA controllers.

MODULE –IV

Introduction to 16 bit microprocessors: Architecture of 8086, Addressing modes, Modular programming– definition, 8086/8088 multiprocessing system, 8087 numeric data processor, 8089 I/O processor, Architecture ofMC 68000.

MODULE –V

Peripheral devices and Interfaces, Pointer interface, Cassette interface, Stepper motor interface, A/D, D/A Convertor chips and their interface, Concepts of interfacing Microprocessor to high power devices, Serial and parallel Bus standards –RS 232C and IEEE 488, Centronix parallel interface standard.

Reference:

1. ***"Microprocessors, Architecture, Programming and Applications",*** Gaonkar, Wiley Eastern, Fourth Edition.
2. ***"Microprocessors, Architecture and Programming",*** A. Nagoor Kani, RBA Publications, 2004.
3. ***"The 8051 Microcontrollers & Embedded Systems",***Mazidi, Pearson Education,Secend Edition.
4. ***"Advanced Microprocessors and Peripherals",***Ajoy Kumar Ray, Kishor Mbhurchandi, TMH, New Delhi, 2000.
5. ***"8086 Microprocessor: Programming and Interfacing the PC",***Kenneth J.Ayala, Thompson Publishing, 1995 (1st Indian reprint 2007).
6. ***"Introduction to 8086 Microprocessor,"*** by W. D. Hall.

University Examination Question pattern:

Part A	- 6 questions of 10 marks from module Ito module V with choice to answer any five.
Part B	- 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI- 3P1 MICROPROCESSOR LABORATORY

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

1. Study of a typical microprocessor trainer kit and its operation.
2. Simple programming examples using 8085 instruction setto understand the use of various instructions and addressing modes.
   (a) Complement a number.
   (b) Addition of binary and BCD numbers.
   (c) Subtraction of binary and BCD numbers.
   (d) Fibonacci series.
   (e) Largest and smallest of numbers.
   (f) Arrange numbers in ascending and descending order.
   (g) Sum of series of numbers.
   (h) Parity checking.
   (i) String concatenation.
   (j) String comparison.
   (k) Elimination of numbers from a string.

BMI – 3P2 BIOMEDICAL INSTRUMENTATION LABORATORY

SessionalExamination: 100 Marks

1. ESU waveform generator
2. Power amplifier for stylus movement
3. Design of pacemaker circuits
4. Study of medical equipments

   1.ECG 2. PCG

   3.EEG 4. EMG

   5.Monitor 6. Sphygmomanometer

   7.Analytical equipments such as colorimeter, pH meter, Hb meter

   8.Fetal monitor 9.Spirometer

   10.Plethysmograph 11.Defibrillator

   12.Oxygenator13.Infusion pump

   14.Syringe pump.

BMI -3P3 SEMINAR-II

Sessional: 50 Marks

The Seminar to be presented shall include any topic of current areas of Bio-Medical Instrumentation coupled with clinical practice. The Seminar shall be carried out under the supervision of Faculty Member in the Department. Students shall individually prepare and submit a seminar report. Each student shall present a seminar for about 15 minutes duration on the selected topic. The report and presentation shall be evaluated based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

BMI- 3P4 HOSPITAL/INDUSTRY TRAINING

Sessional: 100 Marks

The students should get one month in-plant training in a hospital/industry.The course of training is intended to serve the candidate to acquire sufficient knowledge, skills and exposure to various Medical Equipments / Instrumentation in the field of operation, calibration, servicing, maintenance – periodical checkup and Installation etc., of Health care equipments used in Hospitals. Industries cover all aspects of job role performed by Bio- medical engineers.

BMI 401 BIOSIGNAL PROCESSING

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper introduces fundamental concepts of signal processing. Itgives an overview of various Biological signals and applications of signal processing in them.

MODULE –I

Discrete Time Systems: Signals – Introduction to biomedical signals – nature – examples – ECG, EMG, EEG, PCG – Discrete time signals – Frequency Domain Representation of Discrete Time Systems and Signals – Sampling Theorem – Properties of Discrete Time Signals – stability and causality– Linear Time Invariant systems– convolution. Z transform – Z transform theorems and properties – Inverse Z transform – Transfer function.

MODULE –II

The Discrete Fourier Transforms: Introduction–Frequency Domain Analysis of discrete time signals – The Discrete Fourier Series – Properties of the discrete Fourier series– Discrete Fourier Transforms–Properties of Discrete Fourier Transforms – Linear Convolution, Circular Convolutionand Block Convolution. Fast Fourier Transform –Decimation in Time and Decimation in Frequency FFT Algorithms–Features.

MODULE –III

Digital Filter Design Techniques: Introduction – Filters –IIR Digital Filters Realizations – Direct, Cascade, Parallel forms. Analog filter approximations –Butterworth Approximation – Design of IIR Digital Filters from Analog filters–Frequency transformation techniques – The method of mapping of impulse transformationand Bilinear transformation.

FIR Digital Filters Realizations – direct, cascade, lattice forms. FIR filter design using Fourier series - use of window functions like rectangular, Hanning, Hamming, Triangular - frequency sampling design.A comparison of IIR and FIR digital filters.

MODULE –IV

Application in Biological Signals: These techniques applied in processing of various signals like ECG, EEG, PCG, Evoked potentials.

Reference:

1. ***"Biomedical signal processing",***D C Reddy, Tata McGraw-Hill, New Delhi, 2005.
2. ***"Digital Signal Processing",***P. Ramesh Babu, Fourth Edition, Scitech Publications (India) Pvt. Ltd., 2007.
3. ***"Digital Signal Processing",***Sanjit K.Mithra, Tata Mc Graw Hill, Third Edition.
4. ***"Designing digital filters",***Charles S.Williams,Prentice-Hall India Ltd, 1986.

University Examination Question pattern:

1.12 questions of 5 marks from module I to module IV with choice to answer any ten.

2. 6 questions of 10 marks from module I to module IV with choice to answer any five

BMI 402 MEDICAL INFORMATICS

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

MODULE I-MEDICAL INFORMATICS

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues, Computer based medical information retrieval, Hospital management and informationSystem, Functional capabilities of a computerized HIS, E-health services, HealthInformatics – Medical Informatics, Bioinformatics.

MODULE II-COMPUTERISED PATIENT RECORD

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application serverprovider, Clinical information system, computerized prescriptions for patients.

MODULEIII-COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING

Automated clinical laboratories-Automated methods in hematology, cytology andhistology, Intelligent Laboratory Information System - Computerized ECG, EEG andEMG, Computer assisted medical imaging- nuclear medicine, ultrasound imagingUltrasonography-computed X-ray tomography, Radiation therapy and planning,Nuclear Magnetic Resonance

MODULE IV- COMPUTER ASSISTED MEDICAL DECISION-MAKING

Neuro computers and Artificial Neural Networks application, Expert system – Generalmodel of CMD, Computer –assisted decision support system-production rule systemcognitivemodel, semester networks , decisions analysis in clinical medicine-computersin the care of critically patients-computer assisted surgery-designing

MODULE V- RECENT TRENDS IN MEDICAL INFORMATICS

Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery computer aids for the handicapped, computer assistedInstrumentation in Medical Informatics - Computer assisted patient education and health-Medical education and health care information.

MODULE VI DATABASES AND COMPUTER NETWORK

Basics of databases- Relational, distributed and other types of databases, Integrity and security of databases, DBMS. Popular databases available in medical related applications.

Basics of Computer networks- types and topologies.

Reference :

1.R.D.Lele "***Computers in medicine progress in medical informatics***", Tata McGraw Hill Publishing computers Ltd,2005, New Delhi.

2. Mohan Bansal, "***Medical informatics***" Tata McGraw Hill Publishing computers Ltd, 2003 New Delhi.

University examination question pattern:

Part A - 6 questions of 10 marks from module Ito module VI with choice to answer any five.

Part B - 12 questions of 5 marks from module Ito module VI with choice to answer any ten.

BMI 403 AUTOMATION AND QUALITY CONTROL IN BIOMEDICAL ENGINEERING

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper is designed to understand the concept of automation and apply the same in the field of medicine. It lays emphasis on specialized robotic systems and critical surgeries performed by them. Also, it attempts to make better understanding of Quality standards and management methodologies in Biomedical Engineering.

MODULE –I

Robotic Surgery: Surgical Robots – Types, Advances and Applications. Technologies involved in Robotic Surgery – Sensors, Actuators, Micromechanics, Communication control, Virtual Reality and Artificial Intelligence. Application of Intelligent tools for Robotic systems design, Integration of Electronics and Communication systems with Human nerve network.

Mobile Robotics: Architecture of Advanced Mobile Robotics, Actuator design, Navigation, Obstacle avoidance, Sensors and Vision systems. Legged Robotic devices, Control of Mobile Robots in Semi structured environment.

MODULE –II

Advanced Robotics: Control, Instrumentation – Navigation – Route planning – Autonomous operation – Haptic interface – Haptic feedback in systems design – System Architecture – Data fusion – System integration, Advances in Micromechatronics.

Robotic systems: Robotic Radio surgery system, Computer assisted surgery and Rehabilitation Robotics in Virtual environment.

MODULE –III

Biomedical Applications of Medical Robotics: Nerve cell repair using Micromechatronics, Micro and Nanodevices for targeted delivery of medicines to tumour sites and diagnosis using navigable biosensors, Surgeries performed using robotic systems– Mitral valve Surgery and minimally invasive surgeries, Surgical procedures in General surgery, Neurology, Urology, Gastroenterology, Cardiology, Orthopedics, Pediatrics and Radio surgery.

MODULE –IV

Quality Control: Quality control tools, Problem solving methodologies, New Management Tools, Quality policy development, Quality function development, designing for Quality, Manufacturing for Quality.

MODULE –V

Need for Standardization: Regional, National, International Standardization, Methods for Testing Standardization, Maintenance of Standardization & Recalibration, Food and Drug Administration Regulations.

Reference :

1. ***"Advanced Robotics and Intelligent Machines",*** J.O.Roy, Darwin G.Caldwell, D.G.Campbell, Institution of Electrical Engineers, 1996.
2. ***"Computer Vision, Virtual Reality and Robotics in Medicine",*** Nicholas Ayache Springer-Verlag, 1993.
3. ***"Robotics Research",*** Raymond A.Jarvis, Alexander Zelinsky Springer, 2003.
4. ***"Embedded Robotics",*** Thomas Braunl Springer, 2003.
5. ***"Sensor Based Intelligent Robots",*** Gregory D.Hager, H.I.Christensen, Horst Bunke, Rolf Klein Springer, 2002.
6. ***"Primer of Robotic and Telerobotic Surgery",*** Garth H.Ballantyne, Jacques Marescaux, Pier Cristoforo Giulianotti Williams & Wilkins, 2004.
7. ***"Total Quality Management",*** Rose.J.E, Kogan Page Ltd., 1993.
8. ***"The Practice ofClinical Engineering",*** Cesar A.Cacere & Albert Zana, Academic Press, New York, 1977.
9. ***"The Essentials of Total Quality Management",*** Prentice Hall of India, 1993.
10. ***"Clinical Engineering: Principles & Practices",*** Webster J.G. & Albert M.Cook, Prentice Hall of India, 1979.

University examination question pattern:

Part A - 6 questions of 10 marks from module Ito module V with choice to answer any five.

Part B - 12 questions of 5 marks from module Ito module V with choice to answer any ten.

BMI 404HOSPITAL MANAGEMENT SCIENCE

(SessionalExamination: 50 MarksUniversity Examination: 100 Marks)

This paper provides an overview of planning, purchasing and maintenance of Hospital equipments. It also supports to understand hospital management and accreditation of hospitals.

MODULE – 1 Hospital Organisation and Management

Hospital as an Organisation – Types of hospitals – Introduction to Clinical, Supportive, and Ancillary Services. Planning of Bio-Medical Department.

MODULE – II General Management

Management Concepts. Planning and Decision Making: Steps and need for planning. Organising: Span of control – delegation and decentralization – line and staff authority. Co-ordination and control: Control process – types of control.

Hospital Information System: Role of information system in decision making at various managerial levels.

MODULE – III Personnel Management

Manpower planning – Recruitment – Selection – Training and Development – Performance appraisal. Collective Bargaining. Motivation.

Industrial Safety: Safety and accident prevention – Accident records.

Ergonomics: Work environment Design. Environment related factors: Fatigue, lighting, ventilation, Temperature, noise, vibration.

MODULE – IV Purchase Management

Importance - Purchase function – sources of purchase – purchase procedure – Tender procedures.

Store: Storekeeping. Inventory control methods – ABC – VED Analysis– Advantages.

Managerial Economics: Cost control – Break even analysis.

Financial Management in hospitals – budgetary control – depreciation.

MODULE – V Marketing Management

Objectives and functions of marketing management – Market planning – Sales promotion – Advertising – Market Research – Sales forecasting.

MODULE – VI Total Quality Management

Quality Control Methods-Quality Circles-Hospital Infection Control-Medical, Clinical and Nursing Audits-Kaizen-JIT-Statistical quality control-Six sigma-Cost and Effect diagram-Pareto analysis.Accreditation: ISO-NABH-JCI

Reference

1.T.R.Banga,S.C Sharma&N.K.Agarwal: Industrial Engineering and Management Science, Khanna Publishers, Delhi 110006

2.Kunders, G.D(2004)-Facilities Planning and Arrangement in Healthcare, Prism Books Pvt Ltd, Banglore.

3.Tripathi P.C and Reddy P.N:Principles of Management.

4.England W.B.& Leenders M.R. Purchasing& Materials Management Tarapore Vala & Sons.

5.S.K.Joshi-Quality Management in Hospitals Jaypee Brothers.

6.Rose J.E:Total Quality Management,Kogan Page Ltd,1993.

7.Kunders, G.D(2002)-Designing for Total Quality in Healthcare,Prism Books Pvt Ltd, Banglore.

8.Kotler Philip: Marketing Management-Analysis, Planning, Implementation and Control.

University examination question pattern:

PART A - 6 questions of 20 marks from module Ito module VI with choice to answer any four.

PART B- 6 questions of 5 marks from module Ito module VI with choice to answer any four.

BMI 4P1 VIVA – VOCE

University Examination: 150Marks

A comprehensive Viva-Voce examination related with all subjects covered in the scheme of study will be conducted by University. The students shall produce the hospital training report, seminar report and project report duly attested by the institutional authorities, before the examiners. The examiners shall evaluate the students in terms of their conceptual grasp of the course of study and practical/analysis skills in the Bio-Medical field.

BMI 4P2 SEMINAR-III

Sessional: 100 Marks

The Seminar to be presented shall include any topic of current areas of research within Bio-Medical Engineering coupled with clinical practice.The Seminar shall be carried out under the supervision of Faculty Member in the Biomedical Instrumentation Department concerned.Students shall individually prepare and submit a seminar report. Each student shall present a seminar for about 30 minutes duration on the selected topic. The report and presentation shall be evaluated based on style of presentation, technical content, adequacy of references, depth of knowledge and overall quality of the seminar report.

BMI 4P3PROJECT WORK

Sessional:150 Marks

The project work shall be carried out in an aesthetic dimension and innovation of creative ideas to be useful in Bio-Medical field. It shall be carried out in a hospital or in a company, individually. It should include a detailed study of any equipment or the equipments and facilities of any area in the hospital.The Project work shall be carried out under the supervision of Faculty Member in the Biomedical Instrumentation Department concerned.A detailedreport on the work done shall be submitted by each student and there will be an internal examination of the project that includes oral presentation regarding the overall work. The final evaluation of the project shall includePresentation of the work, Oral examination and Quality and content of the project report.

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