With effect from Academic year 2017-18

SCHEME OF INSTRUCTION

B.E. (Biomedical Engineering)

VI - SEMESTER

With effect from the Academic year 2017-2018

S. No	Course Code	Course Title	Scheme of Examination		L	T	P	Hrs/ Wk	Credits
			CIE	SEE					
1.	PC601BM	Basic Clinical Sciences Th-I (Nephrology, Neurology)	30	70	3	0	0	3	3
2.	PC602BM	Basic Clinical Sciences Th-II (Gastroenterology, General Surgery)	30	70	3	0	0	3	3
3.	PC603BM	Basic Clinical Sciences Th-III (Imaging Sciences & Radio therapy, Anaesthesia)	30	70	3	0	0	3	3
4.	PC604BM	Basic Clinical Sciences Th-IV (Cardiology, Orthopaedics)	30	70	3	0	0	3	3
5.	PC605BM	Medi embedded systems and RTOS	30	70	3	1	0	4	3
6.	OE-I*	Open Elective-I	30	70	3	0	0	3	3
	Practicals								
7	PC651BM	Basic Clinical Sciences Pr-I (Nephrology, Neurology)	10	20	0	0	2	2	1
8.	PC652BM	Basic Clinical Sciences Pr -II (Gastroenterology, , General Surgery)	10	20	0	0	2	2	1
9.	PC653BM	Basic Clinical Sciences Pr -III (Imaging Sciences & Radio therapy, Anaesthesia)	10	20	0	0	2	2	1
10	PC654BM	Basic Clinical Sciences Pr -IV (Cardiology, Orthopaedics)	10	20	0	0	2	2	1
11	PC655BM	Medi Embedded Systems Lab	25	50	0	0	3	3	1
Total			**245**	**550**	**18**	**01**	**11**	**30**	**23**

OE-I* # Open Elective-I:

*OE661BM Micro Electro- Mechanical Systems
*OE662BM Engineering Applications in Medicine

OE662CE Disaster Management
OE663CE Geo Spatial Techniques
OE664CS Operating Systems
OE665CS OOP using Java
OE666EC Embedded Systems
OE667EC Signal Analysis and Transform Techniques
OE668EE Reliability Engineering
OE669ME Robotics
OE670ME Material Handling
OE671LA Intellectual Property Rights

***OE661BM and OE662BM are Electives offered for CE/CS/EC/EE/ME**

With effect from Academic year 2017-18

PC601BM

BASIC CLINICAL SCIENCES THEORY-1

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives

- To introduce the students to basic concepts of neurology and nephrology

Course Outcomes

1. to understand physiological functioning of kidney and nervous system
2. to identify renal failure rectification process
3. to determine principles of dialysis and various dialyzers
4. to understand the various disorders of neuromuscular system
5. evaluate neuromuscular system using electrophysiology and imaging

PART-1-NEPHROLOGY

UNIT-I

Anatomy of Kidney. Renal function. Laboratory evaluation. Diagnostic application of Radio Nuclides in Renal Medicine. Acute Renal failure. Chronic Renal Failure.

UNIT-II

Principles of dialysis: Haemodialysis, Acetate dialysis. Bicarbonate dialysis. Peritoneal dialysis. Chronic Ambulatory peritoneal dialysis. Haemoperfusion, sequentialultra filtration. Haemofiltration, Adequacy of dialysis. Clearance, Dialysance.

UNIT-III

Components of dialysing system. Dialysate, composition of dialysate. Types of dialysers. Controls and monitoring devices of dialysers. Clinical significance.

UNIT-IV

Renal transplantation. Basic Principles, Cadaver and donor types of transplantation, Tissue typing tests.

UNIT-V

Treatment of city water for Haemodialysis usage. Types of water, purification systems. Water softeners. De-ionisers. Reverse osmosis.

Suggested Reading

1. Stranss and Welt, *Diseases of Kidney*, Vol.1 and 2, Little Brown
2. Salmon and Paper, *Clinical Nephrology-The Kidney Diseases*.

PART-II-NEUROLOGY

UNIT-I

Review of the structure and function of the nervous system. Central nervoussystem. Peripheral nervous system. Autonomic nervous system.

UNIT-II

Parts of the brain. Brain structure. The motor system. Sensation. Cranial nerves. Functional topography of the brain. Electrophysiology of eye. EOG. ERG. Spinal cord. Consciousness. Higher Functions.Speech.

UNIT-III

Diseases of nervous system. Diagnostic investigations. Spinal Cord Lesions. Motor neuron disease.
Prolapsed intravertebral disc. Neuropathis. Myasthevia gravis. Disease of muscle.

UNIT-IV

Diagnostic investigations. Electro Encephalography. Computerized Axial Tomography. Radio-active Brain Scanning. Angiography. Pneumoencephalography. Recording.

UNIT-V

The motor unit. The methods of Electro-diagnosis. Neuromuscular stimulation. Electromyography, Clinical applications. Diseases of muscle. Motor neuron disorders. The electrical study of reflexes. Disorders of neuromuscular transmission.

Suggested Reading:

1. Adams and Victor-*Principles of Neurology*
2. Brodal-*Neuroanatomy*
3. Lance and Mcleod-*Physiological approach to clinical Neurology*

With effect from Academic year 2017-18

PC602BM

BASICAL CLINICAL SCIENCES THEORY-II

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives

- To introduce the students to basic concepts of gatroenterology and general surgery.

Course Outcomes

1. to understand the symptoms and features of GIT disorders
2. to evaluate the digestion process of Carbohydrates proteins and fats
3. to demonstrate various equipment used in gastroenterology
4. outline the various surgical procedures and their complications
5. to study operation of various surgical equipments used in general surgery

PART-I GASTROENTEROLOGY

UNIT I

Anatomy and Physiology and G.I.T diseases: Stomach(ulcers), Liver(jaundice), Gall Bladder(gall stone). Disease diagnosis and treatment. Juices-Gastric, Bile, Pancreatic, Intestinal, including their functions and clinically significant symptoms-signs and diseases.

UNIT II

Digestion of Carbohydrates, Proteins and Fats. Nutritional support and parental nutrition. Height and weight estimations according to age.

UNIT III

Colonoscopy, Ryles's tube, Laparoscopy, C.T scan & ultrasound of Abdomen, Liver Biopsy.

UNIT IV

Endoscopy: Video endoscopy, fiber optic endoscopy, various endoscopic procedures, indications for E.R.C.P, therapeutic uses of endoscope in gastroenterology.

UNIT V

Intravenous cannulae. I.V. sets. Infusion pumps, stomach wash tubes, Nebulizers-types of humidifiers, sterilization of the equipment.

Suggested Reading:

1. Dent. Stodel, Turcoffe-*Surgical Endoscopy*
2. Bouchire, Allan-*Text Book of Gastroenterology*

PART-II-GENERAL SURGERY

UNIT-I

Surgical Patient, Clinically significant Investigations. Preoperative care, Post operative care and complications. Preoperative investigations for Hernia surgery. Nutritional support before and after operation. Consent by patient. Distribution of water in the body

UNIT-II

Shock and wound healing: Account of shock. Various kinds of shock. Neuro endocrine response of trauma. Types of hemorrhage. Causes of shock. Hypokalaemia. Dehydration. Metabolic acidosis. Acidosis and alkalosis. Cardiac arrest.

UNIT-III

Process of wound healing: Collagen. Ground substance. Epithelial covering. Scar formation Factors modifying wound healing. Nosocomal infection. Oterectasis.

UNIT-IV

Study and operation and surgical equipment. Method of sterilization. Types of endoscopes. Laparoscopy and its use in various surgeries, Micro surgical equipment. Role of cautery. Diathermy. Suction apparatus.

UNIT-V

Surgical equipment: Tissue forceps. Atraumatic needle. Oat gut. Stethoscope. Self retaining retractors. Staples. Prolene mesh, cold light sources. Fiber optic Instruments.

Suggested Reading:

1. Farguhersons, *Textbook of Operative Surgery*
2. Tean W. Salesh, *Laparoscopy*
3. Schwartz, *Principles of surgery*

PC603BM

BASIC CLINICAL SCIENCES THEORY-III

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives:

- To introduce the students to basic concepts of imaging sciences, radiotherapy and anesthesia.

Course Outcomes

1. to study various imaging procedures and equipments
2. to summarize various cancer therapy techniques
3. to understand Nuclear medicine and precautionary measures to be taken
4. to discuss different anesthesia techniques along with monitoring devices
5. to illustrate various machines used in anesthesia

PART-I-IMAGING SCIENCES&RADIOTHERAPY

UNIT-I

Physical principles of X-Ray diagnosis. Photographic effect of X-Ray films. Density, definition, contrast and distortion. Controlling factors. Speed of X-Ray films. Fluorescence, fluorescent and intensifying screens. Scattered Radiation and use of cones and grids. High KV technique. Tomography, image intensification and cine radiography.

UNIT-II

Introduction of Ultra-sonography and computerized Tomography. Principles of MRI. Digital subtraction Angiography. Organ imaging procedures. Central nervous system. Cardio Vascular System. Respiratory System. The thyroid. The liver, the spleen. The pancreas. The skeletal system. The kidney.

UNIT-III

Principles of radiation oncology and cancer radiotherapy. Perspective, Radio-sensitivity and Radio-resistance of tumours and tissues. Classification of tumours according to cell radio-sensitivity. Cell survival theory. Cell repair radio-curability of tumours. Therapeutic ratio. Normal tissue tolerance dose. Modification of radiation response. Physical, chemical and biomedical modifiers.

UNIT-IV

Tele-therapy Equipment. Selection of treatment method. Indications. X-Ray therapy machines-Kilo-Voltage, super-voltage, Mega-Voltage. Telecobalt and Caesium machines. Linear accelerator. Electron therapy. Rotational therapy. Beam definition and beam direction devices. Wedge filters. Compensators. Beam flattening devices. Brachy therapy. Sealed radio active sources. Radium dosage system. Interstitial implantation. Planner implants. Volume implants.

UNIT-V

Nuclear Medicine. Nuclear Medicine Instrumentation. Radiation detectors. Auxiliary instruments. Quantitative measurements in vitro, in vivo. Determination of distribution of

radioactive material within the body. Mass spectrometer, rectilinear scanner, renograph, Gamma Camera. Use of radioactive detectors- for health protection. Therapeutic uses of radio Isotopes(Unsealed).

Suggested Reading:

1. Meredith and Massay, *Fundamental Physics of Radiology*
2. Johns and Cunningham, *The physics of Radiology*
3. Ramesh Chandra, *Introduction to Nuclear Medicine*

PART-II-ANAESTHESIA

UNIT-I

General anaesthesia. The uptake of anaesthetic gases and vapours. Pre-anaesthetic care and preparation. Clinical signs of anaesthesia. Post operative care. Laws of gases. Fires and Explosions. Recommendations for prevention.

UNIT-II

Anaesthetic gases. Equipment. Components. Gas delivery systems. Testing Choice of anaesthetic hypnosis. Electrical anaesthesia. Regional Spinal. Care and sterilization of equipment. Patient monitoring during surgery. Monitoring of respiration and temperature. Invasive and non invasive monitoring-recent trends. Organization of theaters.

UNIT-III

Mechanism of respiration. Gas exchange. Hypoxia, Artificial respiration. Diagnostic and therapeutic indications. Study of ventilators. Humidifiers. Constant pressure and constant volume types. Selection Criteria. Premature baby incubators.

UNIT-IV

Gas pipe lines. Gas flow meters of various types. Boyles machine. Warning devices. Anaesthesia circuits. Vaporizers. Principles of operation. Calibration. Repairs. Recalibration. Scavenging systems. Oxygen therapy and blood gas analysis.

UNIT-V

Measurement of Intra-vascular pressures. Blood flows. Plethysmography. Humidity and temperature measurements. Clinical significance.

Suggested Reading:

1. Sykes M. K and Vickers M. D., *Measurement in Anaesthesia*, Blackwell, 1981
2. Mushin. *Automatic Ventilation of Lung*, Blackwell,1976
3. Miller R. D., *Text book of Anaesthesia*

PC604BM

BASIC CLINICAL SCIENCES THEORY-IV

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives:

- To introduce the students to basic concepts of cardiology and orthopedics

Course Outcomes:

1. to understand various Diagnostic tools used in cardiology
2. to summarize various cardiac therapeutic equipment
3. to demonstrate different cardiac invasive procedures
4. compare various Physiotherapy equipment
5. to examine various Orthopedic rehabilitative devices

PART-I-CARDIOLOGY

UNIT-I

Heart structure and function. Cardiac cycle. Various valves and their functions. IABP. Cardio vascular measurements. Prosthetic devices. Monitors. Heart lung machine. Applications. Clinical significance. CVP and SWAN Catheters.

UNIT-II

Electrocardiography: Sources of ECG potentials. Dipole theory. Conduction system. Normal and abnormal ECGs. Diagnostic applications. Interpretation of ECG. Cardiac pacing. Diagnostic indications. Criteria for selection. Therapeutic indications. Complications. Nursing management of the patient with pacemaker. Temporary pacing. Permanent pacing.

UNIT-III

Fibrillation: Atrial and ventricular, Application of cardiac Assist Devices. Cardiac Catheterization. Echo Cardiography. Cine Angiography. Treadmill, Ergo meter. Applications, Clinical significance.

UNIT-IV

Diagnostic usage of ultrasound scanners. Doppler ultrasound measurements. Clinical significance.

UNIT-V

Open heart surgery grafts. By pass surgery. Instrumentation used for open-heart surgery. Organization of ICCU. Clinical aspects.

Suggested Reading:

1. Ruch Patton, *Biophysics/ Physiology in Volumes*.
2. Glasser, *Medical Physics*
3. *Cardiovascular Assist Devices*
4. Rushmer, *Cardiovascular Dynamics*
5. Burton, *Cardiovascular Physiology/Bio-Physics*

PART-II-ORTHOPAEDICS

UNIT-I

Bone: Structure. Type of material. Remodelling and growth(used for Internal Fixation. Stress and Strain at fracture site). Fractures: Normal Healing. Materials Stress and strain at fracture site.

UNIT-II

Dislocations: Classification of Joints. Reduction. Replacements. Muscle power of grading. Balance achieved at foot. Knee and hand.

Supports and Prosthesis. Hospital Review. Materials and their use. Engineering considerations in the design of Orthopaedic appliances. Tools and Machinery used. Supports and Braces for spine and trunk. Upper extremity appliances. Lower extremity appliances.

UNIT-III

Measurements. Range of joint motion. Marking of joint areas. Measurements of upper extremity, lower extremity, body girths. Shoe measurements.

UNIT-IV

Physiotherapy. Short wave diathermy. Microwave diathermy. Ultrasonic diathermy. Cervical traction. Dynamic and Static exercises. Arthroscopy of Orthotics workshop.

UNIT-V

Electro Induction for bone growth. Ultrasound and other methods. Role of external fixtures in the orthopaedic Surgery.

Suggested Reading:

1. Wilton H. Bunch and Robert D. Kaegy, *Principles of Orthetic treatment*.
2. John Crawford Adams Churchill, *Outline of Orthopaedics and outline of fractures.*
3. Frankel and Nordin, *lea and Basic Biomechanics of the Febiger: skeletal system*.
4. Pauline M. Scott: Clayton's *Electrotherapy and Action therapy.*

PC605BM

MEDI EMBEDDED SYSTEMS AND RTOS

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives:

- To know the basic concepts of embedded systems.
- Able to write programs to interface with 8085/8086/8051.
- Know the concept of interfacing ARM microcontroller.

Course Outcomes:

1. Ability to understand and develop and embedded system
2. design concepts related to hardware and software of embedded system
3. illustrate the concept of kernel and its objects
4. develop the concept of interfacing hardware devices to microcontroller
5. to design medical devices using embedded systems

UNIT-I

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

UNIT-II

Embedded System Development -The development process, requirements engineering, design, implementation, integration and testing, packaging, configuration management, management of development projects. The execution environment-memory organization, system space, code space, data space, unpopulated memory space, i/o space, system start up, interrupt response cycle, Functions Calls & Stack Frames, run time environment.

UNIT-III

Architecture of Kernel, Tasks and Task Scheduler - Task States, Content Switching, Scheduling Algorithms, Rate Monotonic Analysis, Task Management Function Calls. Interrupt Service Routines, Semaphores, mutex, mailboxes, message queues, event registers, pipes, signals, timers, memory management, Priority Inversion Problem

UNIT-IV

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

UNIT-V

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

Suggested Reading:

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

With effect from Academic year 2017-18

PC651BM

BASIC CLINICAL SCIENCES PRACTICE-I

Instruction:	2 Periods per week
Duration of SEE:	Grade: Excellent/Good/ Satisfactory/Unsatisfactory
SEE:	20 Marks
CIE :	10 Marks
Credits:	1

PART I-NEPHROLOGY

Demonstration /Practicals

1. Dialysers
2. Dialysate preparation
3. Haemodialysis machine.
4. Peritoneal dialysis
5. Water treatment Plant.

PART II-NEUROLOGY

Demonstration /Practicals

1. EMG recorder
2. EMG stimulators
3. EEG recorder
4. Special techniques in EEG
5. Cerebral angiography
6. Myelograph

PC652BM

BASIC CLINICAL SCIENCES PRACTICE-II

Instruction:	2 Periods per week
Duration of SEE:	Grade: Excellent/Good/ Satisfactory/Unsatisfactory
SEE:	20 Marks
CIE :	10 Marks
Credits:	1

PART I-GASTROENTEROLOGY

Demonstration/Practicals

Study and operation of:

1. Infusion pumps
2. IV sets
3. Endoscopic Instruments
4. Stomach wash tubes

PART II- GENERAL SURGERY

Demonstration/Practicals

Study and operation of:

1. Surgical equipment-Adult and paediatric
2. Suction apparatus
3. Cautery
4. Light Sources
5. Laparoscopic Instruments
6. Micro Surgical Equipments.

PC653BM

BASIC CLINICAL SCIENCES PRACTICE-III

Instruction:	2 Periods per week
Duration of SEE:	Grade: Excellent/Good/ Satisfactory/Unsatisfactory
SEE:	20 Marks
CIE :	10 Marks
Credits:	1

PART I-IMAGING SCIENCE&RADIO THERAPY

Demonstration/Practicals

Study and operation of:

1. X-Ray plant
2. X-Ray film developing technique
3. Spiral CT
4. MRI
5. Co-60 Teletherapy unit
6. Linear accelerator
7. Gamma camera
8. Scintillation counters
9. Ionization chambers

PART II-ANAESTHESIA

Demonstration/Practicals

Study and operation of:

1. Endotracheal tubes
2. Electro-surgical generators
3. Cold light sources
4. Servo Ventilators
5. Boyles apparatus
6. Spinal and epidural needles
7. Pulse oximeter
8. Ventilators
9. CSSD equipment
10. Cylinders for anaesthetic gases

With effect from Academic year 2017-18

PC654BM

BASIC CLINICAL SCIENCES PRACTICE-IV

Instruction:	2 Periods per week
Duration of SEE:	Grade: Excellent/Good/ Satisfactory/Unsatisfactory
SEE:	20 Marks
CIE :	10 Marks
Credits:	1

PART I-CARDIOLOGY

Demonstration/Practicals

Study and operation of:

1. ECG recorder and monitor
2. Holter monitor
3. Stress test
4. Pacemakers
5. Defibrillators
6. Heart lung machine
7. Hypothermia Unit
8. Oxygenators
9. Blood gas analyzers
10. Electrolyte analyzer etc.

PART II-ORTHOPAEDICS

Demonstration/Practicals

Studyand operation of:

1. Orthotics
2. Splints
3. Prosthetic devices
4. Fracture fixation devices
5. Short wave diathermy
6. Microwave diathermy
7. Ultrasound diathermy

With effect from Academic year 2017-18

PC655BM

MEDI EMBEDDED SYSTEMS LAB

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	50 Marks
CIE :	25 Marks
Credits:	1

Course Objectives:

- To know the basic concepts of embedded systems.
- Able to write programs to interface with 8085/8086/8051.

Course Outcomes:

1. Analysis of interfacing with ARM-7 and MSP430F54xx
2. Interfacing of matrix sensors to PIC microcontroller

1. with ARM-7 and MSP430F54xx
    a) Study and analysis of interfacing of LED.
    b) Study and analysis of interfacing of switches.
    c) Study and analysis of interfacing of 12 bit internal Alphanumeric LCD.
    d) Study implementation analysis and interfacing of 4x4 matrix keypad.
    e) Study of I2C based EEPROM interfacing
    f) Study of SPI based EEPROM interfacing
    g) Study of Stepper Motor interface
    h) Study of Stepper Motor interfacing and its Direction and Angle Control
    i) Study of DC Motor interfacing and its Direction Control
    j) Study of Servo Motor interfacing and its Angle Control
    k) Study of PWM concept

2. Interfacing of matrix sensors to PIC microcontroller
    a) Pin to pin study of MCU
    b) To study of initialization of internal fix PWM
    c) To study of Initialization of internal PWM with variable duty cycle using Internal ADC
    d) Heart rate monitor
    e) ECG sensor

OE661BM

MICRO ELECTRO MECHANICAL SYSTEMS

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to various disciplines.

Course Outcomes:

1. Ability to design the micro devices, micro systems using the MEMS fabrication process.
2. Ability to understand the operation of micro devices, micro systems and their applications.

UNIT-I

Introduction Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators –Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review ofElectrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT-II

Sensors and Actuators-I Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor –Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermalexpansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – MagneticActuators –Micromagnetic components – Case studies of MEMS in magnetic actuators-Actuationusing Shape Memory Alloys.

UNIT-III

Sensors and Actuators-II Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators –piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flowsensors.

UNIT-IV

Micromachining Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies -Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration ofsacrificial Etch -Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS –Foundry process.

UNIT-V

Polymer and Optical Mems Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene –Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS –Lenses and Mirrors – Actuators for Active Optical MEMS.

Suggested Reading:

1. Tai Ran Hsu, *MEMS & Micro systems Design and Manufacture*, Tata McGraw Hill, New Delhi, 2002.
2. Chang Liu, *Foundations of MEMS*, Pearson Education Inc., 2012.
3. Stephen D Senturia, *Microsystem Design*, Springer Publication, 2000.
4. Mohamed Gad-el-Hak, editor, *The MEMS Handbook*, CRC press Baco Raton, 2001.

OE662BM

ENGINEERING APPLICATIONS IN MEDICINE

Instruction:	3 Periods per week
Duration of SEE:	3 Hours
SEE:	70 Marks
CIE :	30 Marks
Credits:	3

Course Objectives:

- Provide a basic knowledge of human physiology to engineering graduate students.
- Understand the applications of various branches of engineering in Medicine.

Course Outcomes:

1. Importance and evolution of medical health care
2. Applications of solid and fluid mechanics in bio medical systems
3. Evaluation of Brain machine interface based systems
4. understand the characteristics and design challenges in signal processing of bio-mechanical systems
5. Choose replacement materials for various implants

UNIT-I

Evolution of Modern healthcare, Major organ systems- Cardiovascular, Respiratory, Nervous, Skeletal, Muscular. Homeostasis. Physiological signals and their diagnostic importance.

UNIT-II

Solid mechanics-Analysis of muscle force and joint reaction force for the limb joints.
Fluid mechanics-Factors governing and opposing blood flow, Wind-Kessel model, Application of Hagen-Poiseuille flow to blood flow.

UNIT-III

Brain-Computer Interface: Brain signals for BCIs, Generic setup for a BCI, Feature extraction and Feature translation involved in BCIs.
Typical applications-Word forming, Device control.

UNIT-IV

Bioelectricity-Excitable cells, Resting potential, Action potential, Accommodation, Strength-Duration Curve, Propagation of impulses in myelinated and unmyelinated nerves.
Medical Instrumentation system-Functions, Characteristics, Design Challenges.
Signal Processing-QRS detection.

UNIT-V

Materials and Tissue Replacements-Types of Biomaterials- Metals, Polymers, Ceramics and Composites and their applications in Soft and Hard tissue replacements.
Implants-Manufacturing process, Design, fixation.

Suggested Reading:

1. John Enderle,Susan m. Blanchard and Joseph Bronzino, *Introduction to Biomedical Engineering*, Second Edition, Elsevier, 2005.
2. Joseph D.Bronzino, *Biomedical Engineering Fundamentals*, 3rd Edition, CRC press, 2006
3. Ozkaya, Nordin. M, *Fundamentals of Biomechanics*, Springer International Publishing, 4th Edition, 2017.