FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING
M.E., REHABILITATIVE INSTRUMENTATION ENGINEERING
REVISED REGULATIONS & SYLLABI
(Students Admitted From the Academic Year 2019-2020)

VISION
To nurture higher echelons of technology through participative education, innovative and collaborative research with a view to bring out employable graduates of International standard.

MISSION
- To establish state of art facilities related to diverse dimension in the field of Instrumentation Engineering, Biomedical Engineering and Microelectronics and MEMS.
- To foster higher quality of education with equivocal focus in theory and practical areas of Electronics, Control and Instrumentation Engineering, Biomedical Engineering and Microelectronics and MEMS.
- To ensure that the dissemination of knowledge reaches the stakeholders and forge the opening of a fresh flair of human resources.
- To create opportunities for advancements in different facets of this discipline and offer avenues to reach the citadels of one's career.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
The major objectives of the M.E (Rehabilitative Instrumentation) programme are to implement Science and Engineering principles in the broad area of medical instrumentation to improve healthcare delivery to human in association with physicians and surgeons and prepare them for:
1. Comprehend the fundamental concepts in Bio Medical Engineering.
2. Apply knowledge of Engineering, biology, and Biomechanical principles to the design, development, and evaluation of various medical devices for cost effective diagnosis and treatment of various ailments.
3. To help the society and specifically the physically challenged person for their comfortable life style.

PROGRAMME OUTCOMES (po)
A student who has undergone the M.E (Rehabilitative Instrumentation) program would have acquired abilities to
1. Possess a good knowledge of basic science (including medicine), mathematics & Engineering required for specific topics in Rehabilitation Engineering.
2. Have skill to use of different types of sensors and measurement of various physiological parameters.
3. Possess ability to provide effective solutions through data interpretation, design & implementation (as applicable to a given topic/scenario).
4. Able to identify the latest tools (hardware &/or software/program &/or materials) available, towards an effective biomedical solution to a given problem.
5. Understand the current healthcare necessities & the associated multidisciplinary environment and sustainability, and an ability to provide appropriate engineering-solutions especially for Physically Challenged persons.
6. Able to take leadership in investigating complex healthcare problems by putting together, a cohesive multidisciplinary team.
7. Able to understand about various imaging modalities used in the Hospitals.
8. Learn some of the latest techniques that can be applied to research.
9. Focuss the experience through Hospital training and projects in one or more areas of advanced research.

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### Control of Biological Systems

#### EIRIPC22
- **PC**
- **Artificial Organ Systems**
- **L T P CA FE Total Credits**
- 3 3 25 75 100 3

#### EIRIPE23
- **PE**
- **Program Elective-III**
- **L T P CA FE Total Credits**
- 3 3 25 75 100 3

#### EIRIPE24
- **PE**
- **Program Elective-IV**
- **L T P CA FE Total Credits**
- 3 3 25 75 100 3

#### EIRIOE25
- **OE**
- **Open Elective – I (Inter faculty)**
- **L T P CA FE Total Credits**
- 3 3 25 75 100 3

#### EIRICP26
- **CP**
- **Bio Instrumentation Lab**
- **L T P CA FE Total Credits**
- 3 3 40 60 100 2

#### EIRITS27
- **TS**
- **Internship* and Seminar**
- **Tr S Pr S Total Credits**
- 40 60 100 2

#### EIRIAC28
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- **Audit Course-II**
- **L T P CA FE Total Credits**
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**Total** 40 60 100 15

*Note: * - *Four weeks during the summer vacation at the end of II*th Semester.*

**L**: Lecture, **P**: Practical, **T**: Tutorial, **CA**: Continuous Assessment, **FE**: Final Examination, **Tr**: Training, **S**: Seminar, **Pr**: Project work

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1526
## M.E(REHABILITATIVE INSTRUMENTATION) PART-TIME

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<td>Personality Development through life Enlightenment Skills</td>
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COURSE OBJECTIVES

To understand basics of Human Anatomy and Physiology.

To understand different physiological processes taking place inside human body.

To impart knowledge on cell divisions, blood vascular system, ductless/endocrine glands, digestive system and nervous system and familiarize medical physiology to the students.

To apply this knowledge into biomedical engineering field.


REFERENCES

COURSE OUTCOMES
By successfully completing this course, students will be able to:
1. Describe and explain specific parts and key terms applied in anatomy and physiology.
2. Describe important physiological mechanisms involved in cell, tissue, and organ.
3. Understand organisation and functions of each organs and systems in human body.
4. Correlate the knowledge of medicine and engineering for the development of various instruments.
5. Understand the diseases associated with various parts of the body.

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COURSE OBJECTIVES
• To impart knowledge on impairment, sensory and auditory rehabilitation, orthopaedic prosthetics and orthotics in rehabilitation.
• To study basics of Rehabilitation Engineering.
• To study various orthotic & prosthetic devices.
• To understand various assistive technology for vision & hearing.


**Computer applications in Rehabilitation and Robotic Manipulation Aids:** Modes of operation and control – interfaces in compensation for visual perception – improvement of orientation and mobility. Computer assisted lipreading – Brain computer interface – concepts.

**REFERENCES**


**COURSE OUTCOMES**

By the end of this course the student will be able

1. To design rehabilitation aid and apply them with confidence, to help the challenged people.
2. To build foundation for learners enabling the learners to pursue higher studies with specialization in Rehabilitation Engineering.
3. To design rehabilitation aids and its understanding.
4. To have a thorough understanding of aids which can be useful with the societal needs.
5. To apply and test the developed products and and automate it.

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Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations


References:

COURSE OUTCOMES
At the end of this course, students will be able to
1. Understand research problem formulation.
2. Follow research ethics
3. Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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**LIST OF EXPERIMENTS**

1. Representation of basic signals.
2. Linear convolution.
3. Autocorrelation and cross correlation.
5. Difference equation Representation of systems using Matlab.
6. Digital IIR Butterworth filter – LPF & HPF.
7. Digital IIR chebychev filter – LPF & HPF.
8. Design of FIR filter using windowing technique.
9. Upsampling and downsampling of Biosignals.
10. Analysis of ECG.
11. Analysis of EEG.
12. Analysis of PCG.

**The list of Experiments will be finalized by the course teacher in consultation with the HOD depending on the availability of equipments, the state of art and recent trends.**

**COURSE OUTCOMES**

1) Students can learn different physiological signals and Images.
2) Students will be benefited by carrying out the experiments with real medical Images.
3) Students will be able know different abnormalities and analyse with the Images.
4) Students can face the society with challenging ideas by using various Image processing Techniques and work with the same knowledge in the Hospitals.
**LIST OF EXPERIMENTS**

1) Temperature measurement using AD590 IC sensor
2) Displacement measurement by using a capacitive transducer
3) Study of the characteristics of a LDR
4) Pressure and displacement measurement by using LVDT
5) Study of a load cell with tensile and compressive load
6) Torque measurement Strain gauge transducer
7) Study & characterization of Biotransducers – Pressure, Temperature, Humidity
8) Study & characterization of Bioelectrodes – ECG, EMG, EEG
9) Study & characterization of Biotransducers – Tactile, Respiration, eyeball movement
10) Study of Gait Analysis

**The list of Experiments will be finalized by the course teacher in consultation with the HOD depending on the availability of equipments, the state of art and recent trends.**

**COURSE OUTCOMES**

1) Students can learn different physiological signals and sensors.
2) Students will be benefited by carrying out the experiments with real subjects.
3) Students will be able know different abnormalities and simulate using the available equipments.
4) Students can face the society with challenging ideas by using various sensors and same can be troubleshooting in the hospitals.

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COURSE OBJECTIVES

- To gain basic knowledge about the concepts of control systems and study its application in physiological modeling.
- To understand the system concepts and different mathematical modeling techniques applied in analyzing any given system.
- To understand basic concepts of modeling for designing biological model.
- To train and motivate students for pursuing higher education and research for developing cutting edge technologies.


Case Study Applications: Cardiac rate – blood pressure – respiratory rate – mass balancing of lungs – oxygen uptake by RBC and pulmonary capillaries – oxygen and carbon dioxide transport in blood and tissues.

REFERENCES


COURSE OUTCOMES
Students will be able to
1. Understand the concepts of modeling.
2. Design control strategies for various organ functioning.
3. Analyse the causes for malfunctioning of organs.
4. Analyse and do research in the micro level for diagnosing the diseases.
5. Theoritically diagnose the kind of diseases for their understanding from the case studies.

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COURSE OBJECTIVES
- To understand the principles and biology underlying the design of implants and artificial organs.
- To understand the fundamentals of materials used for manufacturing implants, prosthesis and orthoses that has wide application in healthcare industry.


REFERENCES

COURSE OUTCOMES
Student will be able to
1. Understand the concept of biocompatibility and the methods of biomaterial testing.
2. Awareness about the testing of the biomaterials done biologically before implantation in the human body.
3. Gain knowledge in the existing designs of artificial organs.
4. Understanding the applications of the organs implants.
5. Develop additional features in the existing instruments.

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LIST OF EXPERIMENTS

1. Respiratory system analysis using Spirometer.
2. ECG wave analysis using simulator.
3. Real time patient monitoring system.
4. 12 – lead ECG measurement System.
5. EMG Biofeedback with NCV.
6. EMG Measurement system.
7. Auditory system check up using Audiometer.
8. ECG heart rate system with HRV.
9. Heart sound measurement using PCG.
12. Design of Medical Amplifier.

** The list of Experiments will be finalized by the course teacher in consultation with the HOD depending on the availability of equipments, the state of art and recent trends.

COURSE OUTCOMES

1) Students can learn different physiological signals.
2) Students will be benefited by carrying out the experiments with real subjects.
3) Students will be able know different abnormalities and simulate using the available equipments.
4) Students can face the society with challenging ideas.

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• To train the students in the field work related to process control and instrumentation and to have a practical knowledge in carrying out process control and instrumentation field related works.

• To train and develop skills in solving problems during execution of certain works related to process control and instrumentation.

The students individually undergo a training program in reputed concerns in the field of Process Control and Instrumentation during the summer vacation (at the end of second semester for full-time/fourth semester for part-time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training they had, within ten days from the commencement of the third semester for Full-time/fifth semester for part-time.

The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

COURSE OUTCOMES

1) The students can face the challenges in the practice with confidence.

2) The student will be benefited by the training with managing the situation arises during the execution of works related to health care system.

3) The student will be able to design a project based on their training.

4) Students can face the society with challenging ideas.

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COURSE OBJECTIVES
1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
2. To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES
Upon completion of this project work, the students will be able to:
1. Take up any challenging practical problems and find solution.
3. Design a given circuit with due interest.
4. Troubleshoot any given circuit and test the results.

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COURSE OBJECTIVES

- To study the production of X-rays and its application to different medical imaging techniques.
- To study the different types of Radio diagnostic techniques.
- To study the special imaging techniques used for visualizing the cross sections of the body.
- To study the imaging of soft tissues using ultrasound technique.

**Introduction to Driving problems in biomedical imaging:** Signal input – image matrix, digital image quality – digital image processing – picture archiving and communication system (PACS) – sources of imaging data acquisition and noise – elementary image processing – Grenander’s Pattern Theory.


**REFERENCES**

**COURSE OUTCOMES**
Student will
1. Get the clear domain knowledge about the various Medical Imaging techniques.
2. To understand the various diagnostic applications of the medical imaging techniques.
3. To apply the imaging modalities in the medical hospitals.
4. To use the advanced techniques to diagnose the health problems.
5. Use their knowledge to use advanced Instruments for imaging.

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**COURSE OBJECTIVES**
- To understand the basic principle, working and design of various automated diagnostic equipments.
- To develop skills enabling Biomedical Engineers to serve Hospitals, National and International Industries and Government Agencies.
- To develop core competency in the field of Biomedical Engineering to gain technical expertise in biology and medicine for effective contribution in the development and improvement of health care solutions.
- To study various medical instrumentation systems, drug delivery systems and health management systems.


**Diagnosis:** Basic principles of echo technique – display techniques A, B and M mode – ultrasound as diagnostic tool – echocardiogram – abdomen – obstetrics – gynaecology – ophthalmology.


**REFERENCES**


**COURSE OUTCOMES**

Student will be able to

1. Demonstrate the principles of electronics used in designing various diagnostic equipment.
2. Have in-depth knowledge about different streams in Biomedical Engineering with greater emphasis on health care equipments and the advanced technologies such as Telemedicine, Telemetry, Medical Imaging, etc.
3. Provide a better technical support with exposure to the hospitals and health care industry.
4. Understand the various techniques and applying for the betterment of the patients.
5. Understand critical care units and its importance
COURSE OBJECTIVES

- Neural engineering and rehabilitation research applies neuroscience and engineering methods to analyze central and peripheral nervous system function and to design clinical solutions to neurological disorders or injury.
- To study the basics of Nervous system.
- To understand the development and arrangement of neural tissue.
- To study the neuronal disorders and injuries.
- To study the repairing and reconstruction mechanism of nervous system.


Equivalent circuit model: Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley’s model of action potential.


REFERENCES

COURSE OUTCOMES
Through this course of study students will be able to
1. Understand the application of basic science and engineering techniques.
2. Develop methods to record from and exert control over the nervous system.
3. Understand and develop the models of associated organ systems.
4. Can carryout research in the analysis of memory of physiological systems.
5. Apply clinically for validation through research

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Global Cancer Incidence and Mortality: Data Source and Measurements, Overall Cancer Risk, Incidence and Mortality Patterns for Common Cancers, Issues in Interpreting Temporal Trends, Analytical Methods for Epidemiological Studies – Ecological Studies, Cross – Sectional Studies, Cohort Studies, Case – Control Studies, Interpretation of Epidemiology Findings, Molecular Epidemiology


REFERENCES
COURSE OUTCOMES
Through this course of study students can able to
1. Understand the basics of molecular biology and cancer.
2. Analyse how Cancer develops and progresses.
3. Design the mathematical modelling and the causes of cancer can be analysed.
4. Understand various treatments methods and Imaging of cancer and the research problems can be solved to the extent.
5. Do research in the area of cancer modeling

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COURSE OBJECTIVES
- To build a strong base for developing algorithms for signal processing systems and Imaging systems.
- To develop competency in terms of logical thinking, programming and application skills.
- To train and motivate students for pursuing higher education and research for developing cutting edge technologies.


**Spectral analysis:** Estimation of power density spectrum – periodogram – parametric model based spectral linear prediction theory – estimation using Auto Regressive (AR), Moving Average (MA) and Auto Regressive Moving Average (ARMA) models. Estimation of parameters – spectral error measure – EEG analysis.


REFERENCES

COURSE OUTCOMES
Student will be able to
1. Understand the fundamental techniques and applications of digital signal processing with emphasis on biomedical signals.
2. Implement algorithms based on discrete time signals.
3. Understand Circular and linear convolution and their implementation using DFT analyse signals using discrete Fourier transform.
4. Understand efficient computation techniques such as DIT and DIF FFT algorithms.
5. Analyse the biological signals for the scope of diagnosis

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COURSE OBJECTIVES
- To familiarize the student with various transportation mechanism in living systems.
- To understand the concepts of organs.
- To study about the internal organs.
- Introduction
- Organization of the human body – cells – tissues – different organs.

Heat transport: Body temperature regulation based on thermostat principle and its operation – transportation in tissues – muscle, skin and other organs in different environmental temperatures.

Transportation of fluids: Blood transport through internal organs – urogenitary – cardio pulmonary and central nervous system.


Lymph: Transportation through internal organs, urogenitary, cardio pulmonary, central nervous and gastro intestine systems. Problems on lymph transfer in human body.

Mass transfer: Constituents of blood, urine, mass transfer in kidney, skeletal, nervous, gastro intestine and cardio pulmonary systems. Comparison with artificial organs.

REFERENCES

COURSE OUTCOMES
Student will be able to
1. Understand the internal organs.
2. Understand the organs functioning in detail.
3. Know the Physics involved in the body fluids.
4. Understand in depth knowledge of human systems.
5. Know about the minarels and liquids present in the body.
COURSE OBJECTIVES

To familiarize the student with cancer and Molecular biology.


REFERENCES

COURSE OUTCOMES

Student will be able to

1. Have clear understanding of basics of cancer and its types.
2. Understand the causes of Cancer.
3. Analyse the modalities for the detection of Cancer.
4. Develop cancer detecting modules.
5. Help the society by the developed products.

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COURSE OBJECTIVES

- To study about the Mathematical Modelling.
- To have knowledge on the Anatomy and physiology of Bones.
- To know how Cancer develops in Bones and affects its function.


**REFERENCES**

**COURSE OUTCOMES**
Student will be able to
1. Understand the types of bone tissues and its structures.
2. Analyse the causes of Bone Cancer.
3. Model the different types of bones and Cancer affected Bones.
4. Do research on the theraptics on Bone Cancer.
5. Design new modalities for diagnosis with study analysis.

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**COURSE OBJECTIVES**
- To acquire knowledge about the various medical imaging techniques.
- To understand the fundamental principle and working of the medical imaging systems involved in the diagnosis of health care.

Tomography: Principle, Plane of Movement, Multisection Radiography, Computerised Axial Tomography, Type of Detection, image reconstruction, Spiral CT, Transverse Tomography, 3D Imaging.

Emission Imaging: Alpha, Beta, Gamma Emission, different types of Radiation Detectors, G.M. & Proportional Counters, Pulse Height Analysers, Isotopic, Scanners, Isotopic Diagnosis of RBC Destruction Rate, GI Bleedings Iron Concentration, Liver Functions, Functions of Gamma Camera, PET, SPECT, PET/CT.


Therapy Using X-Rays and Isotopes 9 Direct and Indirect effects of high energy radiation, Units for radiation Exposure, Depth Dose curves, Linear Accelerator Betatron, Cobalt and Cesium Therapy, Computation of Absorbed Dose Level, Automatic Treatment Planning, Hazardous Effects of Radiation, Radiation measuring units, Allowed Levels, ICRP regulation Protection Methods.

REFERENCES

COURSE OUTCOMES
Student will be able to
1. Understand the different methods and modalities used for medical imaging.
2. Learn the preferred medical imaging methods for routine clinical applications.
3. Understand the engineering models used to describe and analyze medical images.
4. Apply these tools to different problems in medical imaging.
5. Develop drugs with the research Analysis
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### Course Objectives
- To learn the fundamental concepts of wavelet
- To apply the wavelet techniques for various biomedical signals.
- To do analysis with the signals and processing

**Introduction to Wavelets:** Introduction to Multirate signal processing – Decimation and Interpolation, Quadrature Mirror Filters, Subband coding, Limitations of Fourier transform, Short time Fourier transform and its drawbacks, Continuous Wavelet transform, Time frequency representation, Wavelet System and its characteristics, Orthogonal and Orthonormal functions and function spaces.

**Multiresolution Concept and Discrete Wavelet Transform:** Multiresolution formulation of wavelet systems – signal spaces, scaling function, wavelet function and its properties, Multiresolution analysis, Haar scaling and wavelet function, Filter banks – Analysis and Synthesis, 1D and 2D Discrete wavelet transform, Wavelet Packets, Tree structured filter bank, Multichannel filter bank, Undecimated wavelet transform.

**Wavelet System Design:** Refinement relation for orthogonal wavelet systems, Restrictions on filter coefficients, Design of Daubechies orthogonal wavelet system coefficients, Design of Coiflet and Symlet wavelets.


**Wavelet Applications:** Denoising of Signals and Images, Image enhancement, Edge detection, Image Fusion, Image compression, Wavelet based feature extraction, Analysis of phonocardiogram signals, Analysis of EEG signals, Speech enhancement for hearing aids.
REFERENCES

COURSE OUTCOMES
Student will be able to
1. Understand an in-depth knowledge about the basic concepts of wavelet and speech analysis
2. Apply wavelet for various physiological signals
3. Analyse the signal features and its functions
4. Do mathematical analysis on various types of Bio signals
5. Develop new algorithms for early diagnosis

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COURSE OBJECTIVES
- To impart knowledge on various aspects of bioinformatics.
- To study in detail about DNA and its formation.

**Basic Concepts of Molecular Biology:** Cells – Chromosomes, DNA, RNA, Proteins, Central dogma of molecular biology, Genomes and Genes – Genetic code, Transcription, Translation and Protein synthesis. Web based genomic and proteomic data bases: NCBI, Gen Bank.


**Gene structure in Prokaryotes and Eukaryotes:** Molecular Structure Prediction – Basic concepts and terminologies related to molecular structures – Basic molecular Visualization – RNA secondary structure prediction – Protein folding problem – Protein Threading – Protein Visualization – Introduction to Drug Discovery.

**Software Tools:** Use of Tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, Clustal W.

**REFERENCES**


**COURSE OUTCOMES**

Student will be able to

1. Understand the concept of Gene structures.
2. Acquire awareness about the computational biology.
3. Work with various software tools.
4. Understands the various aspects of informatics applied in health industry so that quality of health care is improved.
5. Analyse the gene formations and diseases.

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## COURSE OBJECTIVES

- Achieve familiarity with some basic ethical framework & understand how these ethical frameworks can help us to think through contemporary questions in medical ethics.
- Students will be able to know about the legal and ethical principles and application of these principles in health care settings & gain knowledge about the medical standards that to be followed in hospitals.

### Introduction to Medical Ethics:
Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics – Fundamental Responsibilities, The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society.

### Ethical Theories & Moral Principles:

### Hospital Accreditation Standards:

### Hospital Safety Standards:

### Medical Equipment Safety Standards:

## REFERENCES
COURSE OUTCOMES

Upon completion of this course the student should be able to demonstrate a measurable increase in their knowledge, skills and abilities related to:

1. Legal and professional guidelines for the health professions.
2. Public duties and consent.
3. Guidelines to obtain medical standards in hospitals.
4. Medical ethics, legal ethics and the differences associated with the medical society.
5. Standards for the devices

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COURSE OBJECTIVES

- To familiarize the student with use of computers in medicine
- To use computers for bio signal analysis
- To automate the hospitals with the help of computers


Computer aids for the handicapped: basic discussion with examples – introduction to computer assisted instruction in medicine – ISDN in medicine.

REFERENCE

COURSE OUTCOMES
Student will be able to
1. Exposed to PC hardware as well as various microprocessor family.
2. Hardware behind data acquisition.
4. Develop insight knowledge about the biometrics and network security.
5. Automate the existing systems with computers.

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COURSE OBJECTIVES
- To understand basics of Tissue Engineering.
- To understand fundamentals of cell mechanisms.
- To teach the Physical & biological principles that serve as the scientific basis for understanding the interactions of biological molecules and cells with biomaterials employed for the fabrication of permanent implantable prostheses and as matrices for tissue engineering.
- To understand application of Tissue Engineering.


**Case study:** cell transplantation for liver – musculoskeletal – cardiovascular and neural systems. Ethical – FDA and regulatory issues of tissue engineering.


**REFERENCES**

**COURSE OUTCOMES**
By successfully completing this course, students will be able to:
1. Understand the importance of tissue engineering in the field of biomedical engineering.
2. Understand the mechanisms involved in interaction of different materials with cells and tissues.
3. Explain different methods involved in characterization and preparation of biomaterials in tissue engineering.
4. Apply the knowledge in creating new models in drug delivery systems using synthetic and basic knowledge on stem cells and its various functional applications and therapy.
5. Design an implant for tissue replacement.
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### Course Objectives

- To understand the generation of X-ray and its uses in imaging
- To know the techniques used for visualizing various sections of the body.
- To learn the principles of different radio diagnostic equipment in Imaging
- To discuss the radiation therapy techniques and radiation safety.

### X-Rays


### Radiation Techniques


### Exposure Controls


### Angiography


### Radiotherapy

REFERENCES

COURSE OUTCOMES
The student is exposed to the
2. Various imaging modalities and current techniques.
3. Radiation safety and precautions to be followed in the Hospitals.
5. Knowledge of radiation and its effects.

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COURSE OBJECTIVES
- To teach the key principles of sports medicine education.
- To enable the students with the knowledge of Biomechanics for the muscles and bones.
- To elaborate about the classification of sport injuries and physiological exercises.


Sports Injuries: Terminology and classification of common sports soft tissue injuries, Pathological changes in sprains, strain and contusion and their management. Regional injuries and their management- injuries of head, ears, eyes, nose, back, shoulders, elbows, hand, abdomen, thighs, knee, leg and ankle.
Rehabilitation procedures of sports injuries, Principles of rehabilitation of injuries, Therapeutic modalities i.e. cryotherapy, hydrotherapy, electrotherapy and lesser therapy. Massage and its techniques.

Physiology of exercise, short and long term effects of exercise on muscular tissues, Physiological principles of development of strength, endurance, speed and flexibility.

Heart role and exercise. Threshold for training effects on heart, Cardiac reserve capacity, blood pressure and exercise. Lungs ventilation during rest and exercise, change in lungs diffusions during muscular activities.

REFERENCES:

COURSE OUTCOMES
The student is exposed to the
1. Awareness in sport Medicine.
2. Techniques to be applied for sports injuries.
3. Applications of Medical techniques for athlete.
4. Physiological exercises for various human systems and developmental strength.
5. New ideas for design projects.

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COURSE OBJECTIVES

- Neural engineering and rehabilitation research applies neuroscience and engineering methods to analyze central and peripheral nervous system function and to design clinical solutions to neurological disorders or injury.
- To study the basics of Nervous system
- To understand the development and arrangement of neural tissue
- To study the neuronal disorders and injuries
- To study the repairing and reconstruction mechanism of nervous system.

**Equivalent circuit model:** Electromotive, resistive and capacitive properties of cell membrane, change in membrane potential with distance, voltage clamp experiment and Hodgkin and Huxley’s model of action potential.


REFERENCES:

COURSE OUTCOMES
Through this course of study students will be able to
1. Understand the application of basic science and engineering techniques,
2. Develop methods to record from and exert control over the nervous system
3. Understand and develop the models of associated organ systems.
4. Can carry out research in the analysis of memory of physiological systems
5. Apply neural networks for detection and analysis of diseases.

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COURSE OBJECTIVES
- To make the student to understand health care sector
- To give awareness about hospital set up in a larger perspective with an emphasis on the systems.


Health Care Regulation: WHO, International Health regulations, IMA, MCI, State Medical Council Bodies, Health universities and Teaching Hospitals and other Health care Delivery Systems

Epidemiology Issues: Epidemiology -Aims – Principles – Descriptive, Analytical and Experimental Epidemiology - Methods - Uses

REFERENCES:

COURSE OUTCOMES
The student is exposed to the
1. Hospital administration.
2. Various environmental challenges in Health care domain
3. History and overview of healthcare system in the country.
4. Understands the regulation and standards.
5. Epidemiology Principles

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COURSE OBJECTIVES
- To teach the key principles for telemedicine and health.
- To enable the students with the knowledge of telemedical standards, mobile telemedicine and its applications.

Telemedicine, telehealth and telecare: History of telemedicine – Main phases of telemedicine – Pre electronic telemedicine. Electronic telemedicine Technical Requirements – Type of information and standards, audio, data, Fax,
Video Types of communications and networking – networking architecture. POTS, ISDN, ATM Other Fixed networks – Air/airless communications, RF, Microwaves, Satellite, GSM, CDPD (Cellular Digital Packet Data) Acquisition/ displays – Acquisition systems Cameras, Scanners, Other medical specialized acquisition system.

**Display systems:** Analogue devices, LCD, Laser displays, Holographic representations, Virtual screen devices Computation / storage systems: Magnetic, Mixed, Optical (laser) devices (only brief description required).


**Constraints for the wide spread use of telemedicine:** constraints linked to economy, social acceptance Strategic planning for telemedicine implementation. Analysis of the present situation and the demand Objectives and strategies – Plan of implementation, Forces affecting technology transfer scenarios for telemedicine.

**REFERENCES**


**COURSE OUTCOMES**

The student is exposed to the
1. Technologies applied in multimedia using telemedicine.
2. Protocols behind encryption techniques for secure transmission of data.
3. Applications of telehealth in healthcare.
4. Concept of the fundamental concepts necessary to for any telemedicine and telehealth activity.
5. Telemedicine and ways of connecting nodal hospitals
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### Course Objectives

- To understand the fundamental engineering aspects of modelling physiological systems.
- To utilize concepts derived from biomedical research to aid in the design of engineering systems.
- To apply system techniques and methods to biomedical problems.


Modeling of cardiovascular system: Block diagram representation of cardiovascular system.

REFERENCES

COURSE OUTCOMES
Student will be able to
1. Acquire an insight into and understanding of the utilization of models, system analysis and analog simulation in the field of bioengineering.
2. Understand basic concepts of modeling for designing biological model.
3. Model and simulate physiological processes for better understanding.
4. Use various simulation softwares for modeling biological systems.
5. Understand micro level analysis of cell signaling.
COURSE OBJECTIVES

- To provide the knowledge of mechanical concepts as applied to human movement.
- To study about the bone structure and cartilage.
- To study the structure, movements, and loads applied to spine, shoulder and hip.
- To study about the fluid mechanic system applied to human body.


**REFERENCES**


**COURSE OUTCOMES**

Student will be able to

1. Understand the definition of biomechanics, prostheses orthoses and its classification and design principles.
2. Develop a better understanding of how mechanical principles influence human motion during everyday life.
3. Analyze the forces at joints for various static and dynamic human activities; analyze the stresses and strains in biological tissues.
4. Understand the principles of mechanics that is used to analyze human movement.
5. Analyse the mechanism of joints and bones

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COURSE OBJECTIVES

- To provide knowledge to students to enable them to troubleshoot the various equipments used in hospitals.


Testing of passive components and semiconductor devices:
Testing of passive components & semiconductor devices: resistors, capacitors & inductors, causes of failure for electronic components, testing procedure for semiconductor devices: special diodes, bipolar transistors, field effect transistor (FET), and thyristor.


REFERENCES:

COURSE OUTCOMES
Students will be able to
1. Understand the concepts of Medical Equipments.
2. Understand the functioning of equipments and usage in Hospitals.
3. Techniques about various electronic circuits in medical equipments.
4. Troubleshoot the medical devices
5. Applying the service concepts in developing new features
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**COURSE OBJECTIVES**

- To equip students with basics of design, construction and development process of devices which are used in medical, clinical or laboratory practice

  **Introduction to Medical Equipments**: Define medical device, Classification of medical device, Medical devices medical instrumentation, Origin of bio-potential, Physiological signal, Human machine interface, Input output and control signal, Data acquisition, Sensor, Amplification, Medical electrical stimulator.


  **Diagnostic Equipment Design**: System description of diagnostic equipment: Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

  **Therapeutic Equipment Design**: System description of therapeutic equipment: Pacemaker, External cardio vector defibrillator, Implantable cardio vector defibrillator, Deep brain stimulation, Functional electrical stimulator (FES), Hemodialysis delivery system, Mechanical ventilator.

  **Implant and Prosthesis**: System description of various implant and prosthesis: Total hip prosthesis, Joint replacement, Design of artificial pancreas, Drug eluting stent and its engineering design - Intraocular lens implant, Cochlear implants, Heart valves.

**REFERENCES**


COURSE OUTCOMES
Students will be able to
1. Understand the basic design of medical devices.
2. Learn various acquisition modules in Medical devices.
3. Learn various therapeutic equipments.
4. Understand the design of implants.
5. Understand more about joint replacements.

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AUDIT COURSES

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COURSE OBJECTIVES:
Students will be able to:
- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission syllabus.
- Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness
- Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the conclusion.

Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

REFERENCES


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<th>EIRIACXX</th>
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COURSE OBJECTIVES:

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming.

Introduction Disaster

Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Repercussions Of Disasters And Hazards:

Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.
Disaster Prone Areas In India
Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics

Disaster Preparedness And Management
Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.

Risk Assessment

Disaster Mitigation Meaning
Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES

COURSE OBJECTIVES
• To get a working knowledge in illustrious Sanskrit, the scientific language in the world. Learning of Sanskrit to improve brain functioning
• Learning of Sanskrit to develop the logic in mathematics, science & other subjects. Enhancing the memory power
• The engineering Scholars equipped with the Sanskrit will be able to explode the huge knowledge from ancient literature.


REFERENCES
1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbhashstri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
COURSE OUTCOMES

Students will be able to
1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood.
3. Being a global language, will help to develop logic in students.

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COURSE OBJECTIVES

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character
- Importance of cultivation of values, Sense of duty, Devotion, Self-reliance, Confidence, Concentration. Truthfulness, Cleanliness
- Character and Competence – Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control, Honesty, Studying effectively

REFERENCES


COURSE OUTCOMES

Students will be able to
2. Learn the importance of Human values
3. Developing the overall personality

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COURSE OBJECTIVES:

Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**History of Making of the Indian Constitution:**
- History, Drafting Committee, (Composition & Working)
- Philosophy of the Indian Constitution:
  - Preamble, Salient Features

**Contours of Constitutional Rights & Duties:**
- Organs of Governance:
  - Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

**Local Administration:**
- District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.
- Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments),
  - Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

**Election Commission:**
- Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

**REFERENCES**
1. The Constitution of India, 1950 (Bare Act), Government Publication.

**COURSE OUTCOMES:**
Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.


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COURSE OBJECTIVES:

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Introduction and Methodology


Thematic overview

Pedagogical practices are being used by teachers, in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices

Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers’ attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Research gaps and future directions

Research design, Contexts, Pedagogy Teacher education, Curriculum and assessment, Dissemination and research impact.

REFERENCES


**COURSE OUTCOMES**

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners.

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy.

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**COURSE OBJECTIVES**

- To achieve overall health of body and mind
- To overcome stress

**Definitions of Eight parts of yog. (Ashtanga)**

Yam and Niyam

**Do`s and Don't's in life.**

- i) Ahinsa, satya, astheya, bramhacharya and aparigraha
- ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

**Asan and Pranayam**

- i) Various yog poses and their benefits for mind & body
- ii) Regularization of breathing techniques and its effects-Types of pranayam

**REFERENCES**

1. ‘Yogic Asanas for Group Tarining-Part-I” :Janardan Swami Yogabhysa Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

**COURSE OUTCOMES:**

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also

   Improve efficiency
COURSE OBJECTIVES

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont’s)
- Verses- 71,73,75,78 (do’s)

Approach to day to day work and duties
Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
Chapter 3-Verses 13, 21, 27, 35,
Chapter 6-Verses 5,13,17, 23, 35,
Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge.
Shrimad Bhagwad Geeta:
Chapter2-Verses 56, 62, 68
Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model. Shrimad Bhagwad Geeta:
Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
Chapter 4-Verses 18, 38,39
Chapter18 – Verses 37,38,63

REFERENCES

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication
2. Department), Kolkata
3. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath,
4. Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES:

Students will be able to:

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.