DISCIPLINE SPECIFIC ELECTIVES (DSE) COURSES OFFERED BY THE DEPARTMENT

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Medical Electronics & Instrumentation	4	3	-	1	Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry OR Physics + Mathematics/Applied Mathematics + Computer Science/Informatics Practices	Basic Instrument-ation & Measure-ment Techniques (DSC 4, Sem II), Micro-processor (DSC 11, Sem IV)

Learning Objectives

- This course introduces the student to the fundamental understanding of various types of Biomedical Signals and their physiological aspects.
- The students analyse the various types of Biomedical instruments and their working and practical implementation.
- Learn about Modern Imaging systems like CT and MRI techniques and various other cardiac instruments.
- Learn about Instrumentation for clinical lab: blood cell counter, oximeter, blood gas and blood ph analyser.
- Learn about the emerging fields like EEG, ECG, EMG etc.
- To learn about patient safety and precaution for instruments and electrodes.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand the basic knowledge of physiology and generation of bio electric signals (ECG, EMG, EEG etc.) in humans.
- Describe cardio vascular monitoring systems , Bed side monitor, ECG-Telemetry.
- Describe the basic knowledge on respiratory and pulmonary measurements.
- Describe modern methods of imaging techniques like CT, X-Ray, NMR and MRI.

- Describe conditions for patient safety
- Describe instrumentation for clinical Lab like Blood cell counters, oximeter, blood gas and blood pH analyser..

SYLLABUS OF ELDSE-4A **Total Hours- Theory: 45 Hours, Practicals: 30 Hours**

UNIT – I (10 Hours)

Biomedical signals and transducers

Physiological systems of human body: Introduction, Origin of biomedical signals, Use of microprocessors, Microcontrollers and computers in medical instruments, **Transducers:** Ultrasound transducer, Radiation and chemical thermometry, optical fibre sensor, biosensors, optical glucose sensor, Electrodes & its types: for ECG, EMG & EEG

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UNIT – II (12 Hours)

Cardiovascular monitoring systems: Patient cardiovascular Monitoring systems Cardiovascular System, blood pressure measurement, cardiac rate and output measurement, Cardiac monitor- Waveforms, ECG amplifier, phonocardiography, Ballisto cardiography, Eco-Cardiograph, Bed side monitor –block diagram- measuring parameters-cardiac tachometer-Alarms-Lead fault indicator-central monitoring. Telemetry – modulation systems – choice of carrier frequency – single channel telemetry systems, Cardiac pacemakers: Introduction, Cardiac defibrillators

UNIT – III (12Hours)

Imaging Systems

X-rays: Properties and production, Block diagram of x-ray machine, Diagnostic radiology, Dental X-ray, Basic principle and components of X-Ray Computed Tomography (CT)

MRI: Principle and NMR imaging components

Introduction to Ultrasonic imaging system.

UNIT – IV (11 Hours)

Patient's safety: Precaution, safety codes for electro medical equipment, Electric safety analyser, Testing of biomedical equipment.

Instrumentation for Clinical Laboratory: Blood cell counters, Oximeter, Blood flow meter, Blood gas analysers, Blood pH analyser.

Measurement in Respiratory system: Physiology of respiratory system, Measurement of breathing mechanics Spiro meter, Respiratory therapy equipment Inhalators ventilators & Respirators, Humidifiers, Nebulizers Aspirators.

Practical component (if any) – Medical Electronics & Instrumentation

Learning outcomes

The Learning Outcomes of this course are as follows:

- Familiarize with functioning of biomedical instrumentation
- Perform experiments on the biomedical instruments, collect & analyze the data
- Prepare the technical report on the experiments carried

LIST OF PRACTICALS (Total Practical Hours- 30 Hours)

1. To simulate Bio potential Amplifier.
2. Study on ECG simulator.
3. Study on EEG simulator.
4. Study on EMG simulator.
5. Study of various leads and electrode position for ECG and EEG.
6. Study of pulse rate monitor (Pulse oximetry).
7. To simulate defibrillator.
8. Measurement of heart sound using electronic stethoscope.
9. Simulation of blood cell counter.
10. Study of NMR using virtual lab.
11. Visit to a Diagnostic lab/Pathology lab/Hospital to understand working of various instruments and preparation of a report.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than ten.

Essential/recommended readings

1. Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH.
2. Joseph J. Carr & John M. Brown, Introduction to Biomedical Equipment Technology, Pearson.
3. Shakti Chatterjee, —Textbook of Biomedical Instrumentation System‖, Cengage Learning.
4. Prof. S.K.VenkataRam-Bio-Medical Electronics and Instrumentation, Galgotia Publications.

Suggestive readings

1. Bertil Jacobson & John G. Webster - Medicine and Clinical Engineering, PHI.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVES (DSE-2)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Advance Computer System Architecture	4	3	-	1	Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry OR Physics + Mathematics/Applied Mathematics + Computer Science/Informatics Practices	Microprocessor (DSC 11, Sem IV) or equivalent to Computer System Architecture, Operating system(DSE 2B, Sem IV)

Learning Objectives

- To give the students an elaborate idea about the different memory systems and buses.
- To introduce the advanced processor architectures to the students.
- To make the students know about the importance of multiprocessor and multicomputer.
- To study about data flow computer architectures
- To make students know about the Parallelism concepts

Learning outcomes

The Learning Outcomes of this course are as follows:

- Demonstrate concepts of parallelism in hardware/software.
- Discuss memory organization and mapping techniques.
- Describe architectural features of advanced processors.
- Interpret performance of different pipelined processors.
- Explain data flow in arithmetic algorithms
- Development of software to solve computationally intensive problems.

SYLLABUS OF ELDSE-4B **Total Hours- Theory: 45 Hours, Practicals: 30 Hours**

UNIT – I (10 Hours)

Computer Architecture & Organization: Instruction codes, Computer instructions, Basics of Input/Output & Interrupts, Complete computer description & design of basic

computer. Control Unit: Hardwired vs. Micro programmed control unit. Flynn's classification.

UNIT – II (11 Hours)

Memory Hierarchy: Hierarchical memory organization, Types of Cache Memory, Memory Interleaving, Replacement algorithms + write policy, Concept of Virtual Memory and Virtual Machine.

Parallel Processing: Definition, Theory of Parallelism. Parallel Computer Models, Implicit Parallelism vs. explicit parallelism, Levels of parallelism. Software Parallelism, Hardware Parallelism.

UNIT – III (12 Hours)

Pipelining: Basic Concepts of pipelining, Linear pipeline processor, Asynchronous and Synchronous models, speed up, Efficiency, Throughput, Instruction pipeline. Pipeline hazards and their Resolution Mechanisms like data forwarding, Delayed Branch, Branch Prediction, Dynamic Branch Prediction, Concept of Vector processing.

UNIT – IV (12 Hours)

Instruction Level Parallelism (ILP) Instruction-level Parallelism: Introduction, Challenges, Limitations, Basic Compiler Techniques for ILP, Branch Prediction, Out of order execution, Dynamic Scheduling, Limitations of ILP. Introduction to Thread Level Parallelism (TLP) and Data Level Parallelism (DLP). Introduction to Virtualisation Architecture, Virtualisation as a concept of Cloud Computing.

Practical component (if any) – Advance Computer System Architecture
(FPGA/Virtual Lab/Tejas Architecture Simulator)

LIST OF PRACTICALS (Total Practical Hours – 30 Hours)

1. To design a 4-bit common bus using 4:1 mux to transfer data from register to bus.
2. To design a 2-bit combinational shifter circuit which implements the logical shift, circular shift, arithmetic shift for both direction.
3. To design 2 bit arithmetic circuit which performs the following arithmetic operations add, add with carry, subtract, subtract with borrow, increment and decrement.
4. Design of Arithmetic Logical Unit ALU
5. Design of Memory: Design of a RAM cell
6. Design of Memory: Design of a 4X4 RAM
7. Design of Direct Mapped Cache
8. Design of Associative Cache
9. Using Architectural Simulator Tejas as
    a. Emulator
    b. Transfer Engine

c. Translational Modules
d. Micro architectural Simulation

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than eight, experiment no. 9 is compulsory.

Essential/recommended readings

1. "Computer Architecture: A Quantitative Approach", by John L. Hennessy and David A. Patterson, Morgan Kaufmann, 5th edition, 2011, ISBN: 9780123838728.
2. "Computer System Architecture" by M. Morris Mano (Pearson Publication)

Suggestive readings

1. "Computer Organization and Architecture", William Stallings, Prentice Hall, 10th edition, 2015, ISBN-10: 013293633X, ISBN-13: 978-0132936330
2. "Advanced computer architecture", Kai Hwang, TMH. 2000

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.

DISCIPLINE SPECIFIC ELECTIVES (DSE-3)

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Transmission Lines, Antenna and Wave Propagation	4	3	-	1	Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry OR Physics + Mathematics/Applied Mathematics + Computer Science/Informatics Practices	Electromagnetics (DSC 14, Sem V)

Learning Objectives

The Learning Objectives of this course are as follows:

- Fundamentals of propagation of electromagnetic waves.
- Basics of transmission lines along with its parameters.
- Wave propagation in different modes of the waveguides.
- Antenna parameters and its radiation mechanism.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand reflection and transmission of uniform plane wave.
- Explain the functioning of transmission line and its performance parameters.
- Understand wave propagation in waveguides and different modes of propagation.
- Explain the radiation mechanism and characteristics of an antenna.

SYLLABUS OF ELDSE-4C **Total Hours- Theory: 45 Hours, Practicals: 30 Hours**

UNIT – I (11 Hours)

Electromagnetic Wave Propagation: Plane Wave reflection at Oblique Incidence:- Laws of Reflection, Snell's Law of Refraction, Parallel and Perpendicular polarisations, Fresnel's Equations and Brewster Angle, Wave propagation in dispersive media, Concept of phase velocity and group velocity

UNIT – II (11 Hours)

Transmission Lines: Typical Transmission lines- Coaxial, Two-Wire, Microstrip and Coplanar, Transmission Line Parameters, Transmission Line Equations, Wave propagation in Transmission lines:- lossy, lossless and Distortionless lines, Input Impedance, Standing Wave Ratio, Power, Shorted Line, Open-Circuited Line and Matched Line, Quarter wave transformer as transmission line application.

UNIT – III (11 Hours)

Waveguides: Introduction to Parallel plate waveguide, Rectangular waveguide, Transverse Electromagnetic (TEM), Transverse Magnetic (TM) and Transverse Electric (TE) modes, cutoff frequency and dominant mode, Intrinsic Impedance, Power transmission and attenuation:- conductor loss and dielectric loss and Rectangular cavity resonator and its resonant frequency.

UNIT – IV (12 Hours)

Antenna: Concept of retarded potentials, Radiation Mechanism, types of antennas, power radiated by Hertzian dipole and its radiation resistance, qualitative analysis of half-wave dipole and quarter-wave monopole antenna, Antenna characteristics, Radiation Pattern, Beamwidth, Bandwidth, Radiation Intensity, Directive Gain, Directivity, Power Gain, Radiation Efficiency, Input Impedance, Effective Area and the Friis Transmission Equation.

Practical component (if any) – Transmission Lines, Antenna and Wave Propagation ***(MATLAB/SCILAB /Any other softwares)***

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand the phasor and its graphical representation for electromagnetic fields.
- Learn reflection and transmission of plane electromagnetic wave.
- Represent graphically various parameters of transmission line.
- Plot field configuration for different modes of the waveguide.
- Understand the radiation pattern and other characteristics of an antenna.

LIST OF PRACTICALS (Total Practical Hours – 30 Hours)

1. Program to determine the phasor of forward propagating field
2. Program to determine the instantaneous field of a plane wave
3. Program to find the electric and magnetic fields of reflected and transmitted wave at the interface of different types of media
4. Program to find the characteristic impedance and the phase constant of a distortionless line
5. Program to find the power dissipated of the lossy transmission line
6. Program to find the total power transmitted through the lossless transmission line
7. Program to plot the field configuration for TE and TM modes in waveguide
8. Program to determine the operating range of frequency for TE10 mode of air filled rectangular waveguide
9. Program to determine Directivity, Bandwidth and Beamwidth of an antenna.
10. Program to plot the radiation pattern of a Hertzian dipole and calculate its radiation resistance.

Note: Students shall sincerely work towards completing all the above listed practicals for this course. In any circumstance, the completed number of practicals shall not be less than nine.

Essential/recommended readings

1. M. N. O. Sadiku, Principles of Electromagnetics, Oxford University Press (2001)
2. Karl E. Longren, Sava V. Savov, Randy J. Jost., Fundamentals of Electromagnetics with MATLAB, PHI
3. J. A. Edminister, Electromagnetics, Schaum Series, Tata McGraw Hill (2006)
4. N. Narayan Rao, Elements of Engineering Electromagnetics, Pearson Education (2006)
5. G. S. N. Raju, Antennas and Propagation, Pearson Education (2001) Transmission Lines,

Suggestive readings

1. W. H. Hayt and J.A. Buck, Engineering Electromagnetics, Tata McGraw Hill (2006)
2. D. C. Cheng, Field and Wave Electromagnetics, Pearson Education (2001)

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.