RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, III- Semester

BE-3001 Mathematics-III

(Syllabus for EX, EE, EI, & BM Branches)

COURSE OBJECTIVE- The objective of this course is to fulfill the needs of Engineers to understand the Applications of Fourier Series, Different Transforms, Complex Analysis & Vector Calculus in order to enable young technocrats to acquire Mathematical thinking of Formulating, Analyzing and Solving a wide range of Practical Problems Appearing in Science & EX/EE/EI/BM Engineering.

Course Contents

Fourier Series: Fourier Series for Continuous & Discontinuous Functions, Expansion of odd and even periodic functions, Half range Fourier series, Complex form of Fourier Series.

Integral Transforms:

Fourier Transform-Complex Fourier Transform, Fourier Sine and Cosine Transforms, Applications of Fourier Transform in Solving the Ordinary Differential Equation.

Laplace Transform- Introduction of Laplace Transform, Laplace Transform of elementary Functions, Properties of Laplace Transform, Change of Scale Property, First and Second Shifting Properties, Laplace Transform of Derivatives and Integrals. Inverse Laplace Transform & its Properties, Convolution theorem, Applications of Laplace Transform in solving the Ordinary Differential Equations.

Functions of Complex Variables: Analytic functions, Harmonic Conjugate, Cauchy-Riemann Equations, Line Integral, Cauchy's Theorem, Cauchy's Integral Formula, Singular Points, Poles & Residues, Residue Theorem , Application of Residues theorem for Evaluation of Real Integrals.

Vector Calculus: Differentiation of Vectors, Scalar and Vector Point functions, Gradient, Directional derivative, Divergence and Curl. Line Integral, Surface Integral and Volume Integral, Stoke's Theorem and Gauss divergence theorem**.**

COURSE OUTCOMES- The curriculum of the Department is designed to satisfy the diverse needs of students. Coursework is designed to provide students the opportunity to learn key concepts of Fourier Series, Different Transforms, Complex Analysis & Vector Calculus.

EVALUATION- Evaluation will be continuous, an integral part of the class as well as through external assessment.

References:

1. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley India.
2. H C Taneja: Advanced Engineering Mathematics, I.K. International Publishing House Pvt. Ltd.
3. C B Gupta & S R Singh : Engineering Mathematics , Mc Graw Hill Education.
4. S S Sastri: Engineering Mathematics, PHI
5. Ramana: Advance Engg. Mathematics, TMH New Delhi
6. Engineering Mathematics By Samnta Pal and Bhutia, Oxford Publication

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

Credit Based Grading System

Biomedical Engineering, III-Semester

BM-3002 Sensors & Transducers for Biomedical Measurements

Course Objectives:

1. To introduce the basic concepts related to the operation of electrical & electronic measuring instruments.
2. To understand operational and application aspects of CRO (normal and storage).
3. To analyze and apply various AC bridges for the measurements of various physical quantities minimizing errors by following proper precautions.
4. To study the principles behind various transducers and their applications in the measurement of various parameters in electrical and mechanical engineering fields.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Understand the basic concepts of electrical units, measurement errors and accuracy.
2. Measure different physical parameters using different transducers.
3. Gain experience in interpreting technical specifications and selecting sensors and transducers for a given application.
4. Apply the principles and practice for instrument design and develop for real world problems.

COURSE CONTENTS

Measurements & Errors: Significance of measurements, methods of measurements: Direct & indirect methods, Mechanical, Electrical, Electronic Instruments, Classification of instruments, Deflection & null type, Characteristics of instruments: accuracy, precision, drift, span & range, Significant Figures, Static Sensitivity, Linearity, hysteresis, Threshold, Dead zone, Resolution, Loading effect etc.

Error & its types: Gross systematic error: Instrumental Error, Environmental error, observational error. Random error: Arithmetic mean, Range, deviation, Average deviation, Standard deviation, variance etc.

CRO & Measurements: Basic CRO Circuit, Dual trace Oscilloscope, Dual beam Oscilloscope, Sampling Oscilloscope, Analog Storage Oscilloscope, Digital Storage Oscilloscope.

Measurement with CRO: Frequency, Voltage, Current, Phase, Dielectric, Frequency ratio etc.

A.C Bridges: General equation for bridge balance, Measurement of inductance, Capacitance and Q of the coil, Capacitance Maxwell's, Wiens, Schering Bridge, Wagner Earth Tester.

Signal generator, Function generator, sweep frequency generator, Pulse and square wave generator, Wave Analyzers, Harmonic Distortion Analyzer, Spectrum Analyzer, Heterodyne frequency meter, frequency counter, measurement errors, automatic and computing counter, Digital voltmeter, Ramp type DVM, Integrating DVM, successive approximation DVM.

Transducer: Electrical transducers, classification of transducers, resistive transducer, resistance thermometers, thermistors, thermocouples, Inductive transducer, LVDT, Capacitive, piezoelectric, hall effect transducers. Measurement of non Electrical quantity: Displacement, strain, flow measurements, Rota meter, Venturi meter, Bourdon tube pressure transducer, temperature.

Sensors: Gas Sensor, NBA agent, Microbial sensor, electro analytical sensor, Enzyme based sensor-glucose sensor, Electronic nose –halitosis, breath analysis. Advances in sensor technology: lab –on –a chip, smart sensor, MEMS and Nano sensor. Radiation sensor , Thermal radiation sensor.

Reference Books:

1. Electrical Electronics Measurement & Measuring Instrumentation by A.K Shawney.
2. Electronics & Instrumentation Measurement by J.B Gupta.
3. Instrumentation & Measurement by Helfrick Cooper, PHI India
4. Electronics Instrumentation, H.S. Kalasi, TMH India
5. Biomedical senses & Measurement by Wane, Pind, Liu, Sprinper.
6. Measurement, Instrumentation, and Sensors Handbook, Second Edition: Two-Volume Set John G. Webster, Halit Eren, CRC Press
7. Measurement System by Doebelin, Tata McGraw-Hill Education
8. Biosensors: Theory and Applications, Donald G. Buerk, by CRC Press
9. Fundamentals of Instrumentation 2nd Edition by NJATC, Cengage Learning; 2 edition

List of Experiments:-

1. To measure the Amplitude, Frequency and Phase difference using Analog Dual Trace Oscilloscope.
2. To measure the some parameters using Digital Storage Oscilloscope (DSO).
3. To measure the unknown value of Inductance and Resistance using Maxwell Inductance Bridge.
4. To measure the unknown value of Capacitance using Schering Bridge.
5. To measure the unknown value of Capacitance and Frequency using Wien's Bridge.
6. To measure the displacement using Light dependent Register (LDR).
7. To measure the temperature using Resistance Temperature Detector (RTD).
8. To Study the characteristics of the Linear Variable Differential Transformer (LVDT).
9. To measure the Intensity of Light on different distance by using Photo Transducer.
10. To measure Displacement using Capacitor pickup

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Credit Based Grading System

Biomedical Engineering, III-Semester

BM-3003 Electronic Devices and Circuits

Course Objectives:

1. To understand the physics of semiconductor electronic devices, the characteristics their equivalent models and the characteristics and operation of the diodes.
2. To understand the internal working of the regulated power supply.
3. To understand the concept of biasing in BJT and JFET so as to able to analyze advanced electronic circuits.

Course Outcomes:

After completing this course, the student will be able to:

1. Get clear understanding of internal physical behavior of PN junction Diode.
2. Understand the breakdown mechanisms in semiconductors so as to construct a Zener voltage regulator used in regulated power supplies.
3. Analyze various rectifiers and filter circuits used in regulated power supplies.
4. Understand the construction, operation and characteristics of Bipolar Junction Transistor, which can be used in the design of amplifiers.
5. Understand the construction, operation and characteristics of JFET and MOSFET, which can be used in the design of amplifiers.
6. Understand the need and requirements of biasing a transistor so that to avoid the failure of electronic circuits due to thermal effects

COURSE CONTENTS

Bipolar Junction Transistors (BJTs)

Physical structure and operation modes, Active region operation of transistor, D.C. analysis of transistor circuits, Transistor as an amplifier, Biasing the BJT: fixed bias, emitter feedback bias, collector feedback bias and, voltage divider bias. Basic BJT amplifier configuration: common emitter, common base and common collector amplifiers. Transistor as a switch: cut-off and saturation modes. High frequency model of BJT amplifier.

Field Effect Transistor (FET)

Junction Field-Effect Transistor (JFET) - Construction, Operation and Biasing, Depletion-type MOSFET, Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics. D.C. operation of MOSFET circuits, MOSFET as an amplifier, Biasing in MOSFET amplifiers, Basic MOSFET amplifier configuration: common source, common gate and common drain types. High frequency Model of MOSEFT amplifier .

Multistage Amplifiers

Amplifier configuration, Multistage or Cascade amplifier: classification of multi-stage amplifier, coupling and frequency response of cascaded systems, effect of cascading on multiuser amplifier gain, impedances bandwidth etc. Types of coupling, cascade and cascode circuits, Miller theorem, Darlington pair, bootstrap circuit.

Power and Tuned Amplifiers

Power amplifier: Class A large signal amplifiers, second-harmonic distortion, Transformer coupled audio power amplifier, Class B amplifier, Class AB operation push pull and Class C power amplifiers. Comparison of their efficiencies, types of distortion.

Tuned amplifier: single tuned, double tuned and stagger tuned amplifiers characteristics and their frequency response.

Feedback Amplifiers and Oscillators

Feedback Amplifiers: Concept of feedback, positive and negative feedback, voltage and current feedback, series and shunt feedback, effect of feedback on performance characteristics of an amplifier, stability criterion.

Oscillators: Condition for sustained oscillation, R-C phase shift, Hartley, Colpitts, Crystal and Wein bridge oscillators, Negative resistance Oscillator, Relaxation Oscillator.

Reference books:

1. Integrated Electronics. - Millman Halkias
2. Electronic Devices & circuits – Boyelstad & Neshelsky – PHI
3. Electronic Devices & Circuits – David A.Bell – PHI
4. Principles of Electronic Devices – Malvino

List of experiments:

1. To design the power supply of +5V & -5V using IC regulator.
2. To draw the forward and reverse bias characteristics of a semiconductor PN junction diode.
3. To draw the characteristics of Zener diode as a voltage regulator.
4. To observe the waveform of Clamper circuit.
5. To observe the waveform of Clipper circuit.
6. To observe the output waveform of half wave rectifier, also calculate its parameters like PIV, Ripple Factor, Form Factor, and Efficiency.
7. To observe the output waveform of full wave rectifier. , also calculate its parameters like PIV, Ripple Factor, Form Factor, and Efficiency.
8. To plot common base input and output characteristics for PNP bipolar junction transistor.
9. To plot common emitter input and output characteristics for NPN bipolar junction transistor.
10. To draw the static characteristics of JFET and find out its parameters.

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Credit Based Grading System

Biomedical Engineering, III-Semester

BM-3004 Human Physiology

Course Objectives:

1. To understand basics of Human Anatomy and Physiology.
2. To study the organs and systems involved in body functions.
3. To apply this knowledge into biomedical engineering field.

Course Outcome:

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 organization and functions of each organs and systems in human body and understanding of biology and physiology the capability to apply advanced mathematics science, and engineering to solve problems at the interface of engineering and biology.

COURSE CONTENTS

Nervous System:

Structure of Neurons, Synapse and neurotransmitters, Central and Peripheral nervous system, various parts of nervous system; Brain: Parts and functions; Spinal cord, CSF, Ventricles of the brain, Autonomic nervous system, Reflex action.

Special Senses:

Eye: Anatomy of Eye & Physiology of Vision, Ear: Structure of Ear & Physiology of Hearing, Nose: Sense of Smell, Tongue: Sense of Taste.

Endocrine System :

Brief idea of location of endocrine glands, Hormones of pituitary, pineal, thyroid, parathyroid, pancreas, adrenal glands and gonads, feedback mechanism. Mechanism of hormone action effects of hypo secretion and hyper secretion of various hormones of the above mentioned glands.

Digestive System:

Anatomy of digestive system, movement of gastrointestinal tract, mastication, deglutination, physiological activities in mouth, pharynx, esophagus, stomach, pancreas, liver, gall bladder, small and large Intestine, Digestion and absorption.

Excretory System:

Anatomy of Urinary System and Structure of Nephron, Physiology of urine formation, physiology of micturition, Concentration and Dilution of urine, Composition of Urine. Principles of Heamodylysis

Reference Books:

1. Anatomy and Physiology in Health and Illness by Ross and Wilson

2. Human Anatomy and Physiology by Dr. Padma Sanghani
3. Text book of Medical Physiology by Guyton and Hall
4. Human Physiology and Anatomy by Fox Staurt Ira
5. Human Anatomy (Volume 1,2,3) by B.D.Chaurasia

List of Experiments:-

1. To record electrical activity of heart of a subject by Electrocardiogram (Limb leads)
2. To record electrical activity of heart of a subject by Electrocardiogram (Chest leads)
3. To record brain electrical activity of a subject by Electroencephalogram (EEG).
4. To record muscles electrical activity of a subject by Electromyogram (EMG).
5. Operation and testing of Stethoscope
6. To Record heart sound of a subject by Phonocardiogram (PCG).
7. To find blood oxygen saturation level using finger Plythesmograph.
8. To measure blood Pressure with Indirect Blood pressure measuring equipment.
9. Operation and testing of Doppler shift Blood Pressure measurement
10. Operation and testing of Patient monitor.

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Biomedical Engineering, III-Semester

BM-3005 Network Analysis

Course Objectives:

1. To make the students able to identify the main circuit elements and apply kirchhoff's laws to calculate currents, voltages and powers in typical dc electric circuits using a variety of analytical methods.
2. To make the students capable to reduce more complicated circuits into the thevenin's and norton's equivalent circuits.
3. Evaluate the time response of basic circuits with one energy storage element to the sudden application of dc voltage or current as well as to the sudden change in the circuit configuration.
4. To make the students capable to define basic parameters describing a sine wave and evaluate the steady state time response of R, L and C elements supplied by sinusoidal voltage or current sources.

Course Outcomes:

After successful completion of the course, student will be able to-

1. Apply the fundamental concepts in solving and analyzing different electrical networks
2. Ability to design the circuit for all theorems.
3. To solve all the algorithm of network analysis.
4. Able to find out the Y and Z parameters.

COURSE CONTENTS

Introduction to LLBP circuit elements R,L,C and their characteristics in terms of Linearity & time dependent nature, KCL and KVL analysis dual networks analysis of magnetically coupled circuits Dot convention, coupling co-efficient, Tuned circuits. Series & parallel resonance voltage & current sources, controlled sources.

Network topology, concept of Network graph, Tree, Tree branch & link, Incidence matrix, cut set and tie set matrices.
Network Theorems – Thevenins & Norton's theorem, superposition, reciprocity, compensation, maximum power transfer and Millman's theorem, problems with controlled sources.

Transient analysis Transients in RL, RC & RLC Circuits initial conditions, time constants. Network driven by constant driving sources & their solutions.
Steady state analysis - Concept of phasor & vector, impedance & admittance. Node & mesh analysis of RL,RC and RLC networks with sinusoidal and other driving sources.

Frequency domain analysis – Laplace transform solution of Integro differential equations. Transform of Waveform – synthesized with step ramp, Gate and sinusoidal functions. Initial & final value theorem. Network Theorems in transform domain.
Concept of signal spectra, Fourier series co-efficient of a periodic waveform. Waveform symmetries. Trigonometric and Exponential form of Fourier series, steady state response to periodic signals.

Network function & Two port networks – concept of complex frequency, port. Network functions of one port & two ports, poles and zeros network of different kinds.
Two port parameters – Z,Y, chain parameters relationship between parameters. Interconnection of two ports. Terminated two port network.

References:

1. M.E. Van Valkenburg, Network Analysis, PHI Publication.
2. F.F.Kuo, Network Analysis, TMH Publication
3. Sudhakar, Circuits & Systems, TMH Publication.
4. Chakrabarti, Circuit Theory, Dhanpat Rai & Co.

List of Experiments:

1. To verify Thevenin theorem.
2. To verify superposition theorem.
3. To verify reciprocity theorem.
4. To verify maximum power transfer theorem.
5. To verify Millman's theorem.
6. To determine open circuit parameters of a two port network.
7. To determine short circuit parameters of a two port network.
8. To determine A, B, C, D parameters of a two port network
9. To determine h parameters of a two port network
10. To find frequency response of RLC series circuit.
11. To find frequency response of RLC parallel circuit.

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Biomedical Engineering, III-Semester

BM-3006 Computer Programming

Basic Java Features - C++ Vs JAVA, JAVA virtual machine, Constant & Variables, Data Types, Class, Methods, Objects, Strings and Arrays, Type Casting, Operators, Precedence relations, Control Statements, Exception Handling, File and Streams, Visibility, Constructors,
Operator and Methods Overloading, Static Members, Inheritance: Polymorphism, Abstract methods and Classes

Java Collective Frame Work - Data Structures: Introduction, Type-Wrapper Classes for Primitive Types, Dynamic Memory Allocation, Linked List, Stack, Queues, Trees, Generics: Introduction, Overloading Generic Methods, Generic Classes, Collections: Interface Collection and Class Collections, Lists, Array List and Iterator, Linked List, Vector. Collections Algorithms: Algorithm sorts, Algorithm shuffle, Algorithms reverse, fill, copy, max and min Algorithm binary Search, Algorithms add All, Stack Class of Package java. Util, Class Priority Queue and Interface Queue, Maps, Properties Class, Un-modifiable Collections.

Advance Java Features - Multithreading: Thread States, Priorities and Thread Scheduling, Life Cycle of a Thread, Thread Synchronization, Creating and Executing Threads, ultithreading with GUI, Monitors and Monitor Locks. Networking: Manipulating URLs, Reading a file on a Web Server, Socket programming, Security and the Network, RMI, Networking, Accessing Databases with JDBC: Relational Database, SQL, MySQL, Oracle

Advance Java Technologies - Servlets: Overview and Architecture, Setting Up the Apache Tomcat Server, Handling HTTP get Requests, Deploying a web Application, Multitier Applications, Using JDBC from a Servlet, Java Server Pages (JSP): Overview, First JSP Example, Implicit Objects, Scripting, Standard Actions, Directives, Multimedia: Applets and
Application: Loading, Displaying and Scaling Images, Animating a Series of Images, Loading and playing Audio clips

Advance Web/Internet Programming (Overview): J2ME, J2EE, EJB, XML.

References:

1. Deitel & Deitel, ”JAVA, How to Program”; PHI, Pearson.
2. E. Balaguruswamy, “Programming In Java”; TMH Publications
3. The Complete Reference: Herbert Schildt, TMH
4. Peter Norton, “Peter Norton Guide To Java Programming”, Techmedia.
5. Merlin Hughes, et al; Java Network Programming , Manning Publications/Prentice Hall

List of Program to be perform (Expandable)

1. Installation of J2SDK
2. Write a program to show Concept of CLASS in JAVA

3. Write a program to show Type Casting in JAVA
4. Write a program to show How Exception Handling is in JAVA
5. Write a Program to show Inheritance
6. Write a program to show Polymorphism
7. Write a program to show Interfacing between two classes
8. Write a program to Add a Class to a Package
9. Write a program to demonstrate AWT.
10. Write a program to Hide a Class
11. Write a Program to show Data Base Connectivity Using JAVA
12. Write a Program to show “HELLO JAVA ” in Explorer using Applet
13. Write a Program to show Connectivity using JDBC
14. Write a program to demonstrate multithreading using Java.
15. Write a program to demonstrate applet life cycle.