EE 441: Advanced computer programming & Data Structures

L T P
3 - 2 – 3
ESE: 100
Sessional 50
Laboratory: 50

1. **Review of 1st semester IC course**: Control structure, decision control structure, case control structure.
2. **File operations**: Opening a file, File opening modes, Closing a file, Reading data from a file, writing data to a file, EOF.
3. **Functions**: What is function, passing values between functions, call by value, call by reference,
4. **Arrays and pointers**: Array definition, array initialization, bound checking, passing an array element to a function, passing an entire array to a function, 2-dimenational array, 3-dimensional array, pointer definition, array of pointers.
5. **Strings**: Definitions, Standard library string functions strlen(), strcpy(), strcat(), strcmp(), 2- dimensional array of characters.
6. **Structures**: Use of structure, Declaration of a structure, accessing structure elements, Storing of structure elements. Array of structures.
7. **Data structures**: Stacks, queues, lists, linked lists, searching, sorting, crops

Note: The C and C++ languages shall be used to describe the algorithms and data structure. Some basic features of project oriented languages shall be covered in the course.

Books/References:

1. M.A.Weiss-Data Structures & Algorithms Analysis in C++ , (Addition Wesley).
2. L. Tannenbaum- Data Structures Using C , (PHI).
3. Lipshutz- Theory and problems of Data Structure, (McGraw Hill).
4. Yashavant Kanetkar -- Let Us C: (BPB)
5. Yashavant Kanetkar --Let Us C++ : (BPB)
6. E Balaguruswamy -- Programming in C: (TMG)

EE 442: Electrical Machines - I (EE)

L T P
(3 – 1 – 0)
Theory Marks =100
Sessional Marks = 50

1. **Electro-mechanical Energy Conversion**:

Principle of energy conversion, Field magnets and induced e.m.f. and torque in rotating machines, Simple commuter and slip rings for supply and collection of current, Magnetically coupled circuits.

2. **D C Machines:**

Constructional features, Details of Lap and Wave windings. Methods of excitations – shunt, series and compound. E M F equation, Armature reaction, Inter-poles and compensation windings, Commutation, Characteristic curves of D C Machines, Efficiency and Regulation, Parallel operation.

3. **D C Motors:**

Speed and Torque characteristic curves of shunt, series and compound motors, Starting of D C motors – Starters and grading of starting resistance, Speed control- conventional methods and solid state control, Choice of motors for different duties, Losses and efficiency, Testing – Swinburne's test, Back to back test, Retardation test and Brake test.

4. **Transformer:**

Principles of operation of transformer, voltage and current ratios, Construction – shell type and core type, cooling method, single phase and poly phase. Emf equation and output equation, Magnetic circuit, leakage flux and leakage reactance, Phasor diagram, per unit values of resistance and reactance, Open circuit and short tests, back to back test, Regulation, losses and efficiency, maximum efficiency, all-day efficiency, Auto-transfer, 3-phase transformer, Phase transformation and connections. Parallel operation of transformer, Vector grouping, Harmonics.

Books:

1. Langsdrof : Theory of Alternating Current Machines(McGraw Hill)
2. Kingsley, Fitzereld : Electric Machinery (McGraw Hill)
3. Say : Preformance and Design of Alternating Current Machine.

EE 444: Electromagnetic Fields Theory (EE)

L T P
(3 – 1 – 0)
Theory Marks =100
Sessional Marks = 50
Time = 3 hours

1. **Vector Analysis:**

Review of dot and cross products, gradient, divergence and curl. Divergence and Stock's theorem, Cartesian, Cylindrical and Spherical co-ordinates system. Transformation between co-ordinates, General curvilinear co-ordinates. Value of gradient divergence and curl in general co-ordinates and to obtain there from their values in cylindrical and spherical co-ordinates.

2. The Static Electric Field:

Coulomb's Law, Electric Field strength, Field due to point charges, a line charge and a sheet of charge, field due to continuous volume charge, electric flux density, Gauss's law in integral form, Gauss's law in differential form (Maxwell's first equation in electrostatics), applications of the Gauss's law.

Electrostatic potential difference and potential, potential and potential difference expressed as a line integral, potential field of a point charge, potential field of a system of charges, conservative property, potential gradient, the dipole, energy density in the electrostatic field.

3. The static magnetic field:

The Biot-Savart's law (the magnetic field of filamentary currents), the magnetic field of distributed surface and volume currents, ampere's circuital law in integral and differential form (Maxwell's curl equation for steady magnetic field).

The scalar and vector magnetic potentials, Maxwell's Divergence equation for B, steady magnetic field laws, forces in magnetic field, force on a current element, force between two current elements, force and torque in a current loop.

4. The Electromagnetic field:

Faraday's law in integral and differential form (Maxwell's first curl equation for electro-magnetic field). The Lorentz force equation.
The concept of displacement current and modified ampere's law (Maxwell's 2nd curl equation for electro- magnetic field), the continuity equation, power flow in an electromagnetic field, the boynting vector.
Sinusoidally time varying fields, Maxwell's equation for Sinusoidally time varying fields, Power and energy considerations for Sinusoidally time varying fields.
The retarded potentials, polarization of vector fields, review of Maxwell's equations.

5. **Materials and fields (review type only):**

Current and current density, the continuity equation, conductor in fields.
Dielectrics in fields: Polarization, flux density, electric susceptibility, relative permittivity, boundary conditions in perfect dielectrics, magnetic materials, magnetization, permeability, boundary conditions.

6. **Applied Electromagnetic I :**

Poisson's and Laplace's equations, solution of one-dimensional cases, general solution of Laplace's equation, method of images.

7. Applied Electromagnetic II:

Electromagnetic waves, the Helm Holtz Equation, wave motion in free space, wave motion in perfect lossy dielectrics, propagation in good conductors, skin effect. Reflection of uniform plane waves- co-efficient of reflection and refraction, characteristic impedance, Radiation of electromagnetic waves- half wave antenna.

8. Transmission line equations and parameters:

Some examples of transmission lines.

Books:

1. Hayt: Engineering Electromagnetics.
2. N. N. Rao: Basic Electromagnetics with applications.
3. Corson and Lofrain: Introduction to Electromagnetic Fields and waves.
4. Bradshaw and Byatt: Introductory Engineering Field Theory.
5. Nussbaum: Electromagnetic theory for engineers and scientists.

L T P

EE 443: Electrical Measurements and Measuring Instruments (EE/IE) (3 – 1 -2)

Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50

1. **Characteristic of instruments and measuring systems**:

Static characteristic – accuracy, sensitivity, reproducibility, drift, static error and dead zone. Dynamic characteristic- response to step and sinusoidal signals. Errors occurring in measurement.

2. **Measuring Instruments**:

Electro-dynamic, rectifier and induction type ammeters and voltmeters – construction, operation, errors and compensation, Electro-dynamic and induction type watt meters, Single phase induction type energy meter. MC and MI type power factor meters. Electrodynamometer type frequency meter, Synchroscope.

3. **Measurement of resistance:**

Wheaston bridge method – sensitivity of the Wheaston Bridge – precautions to be taken while making precision measurements, Limitations, Carey-Foster slid Wire Bridge.

Measurement of low resistance – Kelvin's Double Bridge.

Measurement of high resistance – direct deflection method. Measurement of volume and surface receptivity. Loss of charge method. Measurement of insulation resistance with power on.

4. **Potentiometers**:

D. C. potentiometer – basic principle. Laboratory type potentiometer. Methods of standardization. Applications- calibration of ammeters and voltmeters, measurement of resistance and power - calibration of watt meters. Volt ratio box, A. C. potentiometers – difference between A. C. and D. C. potentiometers. Types - polar and co-ordinate type. Application of A. C. potentiometer.

5. **A. C. Bridge**:

General principle, Balance equation. Sources and Detectors used in A. C. Bridges. Balance condition and Phasor diagrams of Maxwell's bridge, Anderson's bridge, Owen's bridge, De Sauty's bridge, Low voltage Schering Bridge, Heavy-side mutual inductance Bridge.

6. **Magnetic Measurement**:

Magnetic hysteresis, alternating current magnetic testing, separation of iron losses. Measurement of iron losses by the watt meter method, Cambell's bridge method and the Oscillographic method.

7. Instrument Transformer:

Use of instrument transformers – ratio, burden. Theory and operation of CTs and PTs – errors and compensation – CT testing – mutual inductance method, Silbee's method. PT testing – comparison method. Power and energy measurement using CTs and PTs. Effect of reverse polarity connection of one of the CTs on 3-phase energy meter.

8. **C.R.O.**:

Basic construction, main parts, principle of operation, Applications. (Thurst has to be to use C.R.O. through suitably designed laboratory experiments)

9. Galvenometers:

Ballastic, D'Arsonval, Vibration

Books:

1. Golding and Widdis – Electrical Measurements and measuring instruments.
2. A.K. Sawhney – Electrical and Electronic Measurements and Instrumentation