Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

UNIT IV

Electrical Machines: 9

Concept of electromechanical energy conversion DC machines: Types, EMF equation of generators and torque equation of motor, Characteristics, and applications of DC Generators & motors.

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Induction Motor: Types, Principle of operation, Torque-slip characteristics, Applications

EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.
10. To draw the magnetization characteristics of separately excited dc motor.
11. To perform the external load characteristics of dc shunt motor.

Textbooks:
1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

BSM-102/BSM-152		**Ordinary and Partial Differential Equations**
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
1. To solve the ordinary differential equations.

2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.
4. Application of partial differential equation in real life problems
5. To solve Wave, Heat and Laplace equation upto two dimensions.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I   9

Ordinary Differential Equations I: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II   9

Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

UNIT-III   9

Partial Differential equations I: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV   9

Partial Differential Equations II: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd..
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

BEE- 107/ 157   **Basics of Measuring & Protective Equipments**

Course category	:	Proficiency
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 0, Tutorial: 0, Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Major Practical Examination.

Course **Objective**   : **1.** To demonstrate and understand the basic principle of operation and construction of different types of electrical measuring instruments.

2. To demonstrate and understand the applications of different types of electrical measuring instruments.

Course Outcomes:

The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic concepts of measurement.
2. Understand the basic concepts of calibration of instruments like voltmeter, ammeter, wattmeter, and energy meter.
3. Understand the use of CT and PT for extension of range.
4. Understand the construction, working principle of operation and performances of different kind of measuring instruments.
5. Student gains knowledge on different Protective Equipment's of Power Systems.
6. Understand the Single line diagram of Substation.

EXPERIMENTS

1. Verification of Kirchhoff's law.
2. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
3. Calibration of ac voltmeter and ac ammeter.
4. Calibration of single induction type energy meter with the help of wattmeter.
5. Extension of range instruments using CT & PT.
6. To study the IDMT over current relay and determine the time current characteristics.
7. To study percentage differential relay.
8. To study Impedance, MHO and Reactance type distance relays.
9. To understand the protection scheme of substation through visit to local high voltage substation and to sketch labelled schematic diagram/single line diagram of it.

Textbooks:

1. E.W. Golding & F.C. Widdis, "Electrical Measurement & Measuring Instrument", A.W. Wheeler & Co. Pvt. Ltd. India.
2. A.K. Sawhney, "Electrical & Electronic Measurement & Instrument", Dhanpat Rai& Sons India .
3. S. S. Rao, "Switchgear and Protection", Khanna Publishers.
4. B. Ravindranath and M. Chander, Power system Protection and Switchgear, Wiley Eastern Ltd.
5. B.Bhalja, R.P. Maheshwari& N. G. Chothani, Protection & Switch Gear, Oxford University Press.
6. B. Ram and D. N. Vishwakarma, "Power System Protection and Switchgear", Tata Mc. Graw Hill

BCE 101   **ENGINEERING GRAPHICS**