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# P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Second Semester, B.E. - Semester End Examination; May / June - 2019

## Basic Electrical Engineering

(Common to All Branches)

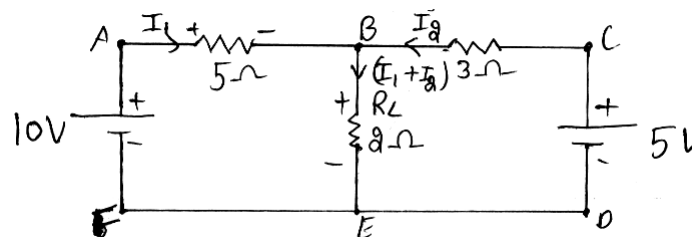
Time: 3 hrs

Max. Marks: 100

Note: Answer FIVE full questions, selecting ONE full question from each unit.

### UNIT - I

- 1 a. State and explain the Kirchhoff's law. 6
- b. Derive an expression for Self induced *emf*. 6
- c. Find the current through  $R_L$  for the network shown in below figure, 8



- 2 a. Define Self and Mutual induced *emf* and derive an expression for coefficient of coupling. 8
- b. State and explain the Faraday's law of electromagnetic induction. 6
- c. Two identical coils of 1200 turns each are placed side by side such that 60% of the flux produced by one coils links other. A current of 10 A in the first coil sets up a flux of 0.12 m Wb. If the current in the first coil changes from +10 to -10 A in 20 ms. Find; 6
  - i) The self-inductances of the coils
  - ii) The *emf*'s induced in both the coils

### UNIT - II

- 3 a. Define the following terms : 6
  - i) Real power
  - ii) Reactive Power
  - iii) Apparent power
  - iv) Power factor
- b. Derive an expression for the average power consumed in a series RC circuit. Draw the related waveform. 6
- c. A coil having a resistance of  $7 \Omega$  is connected in series with an inductance of 31.8 mH to a source of 230 V, 50 Hz supply. Calculate; 8
  - i) The circuit current
  - ii) Voltage across each element
  - iii) Phase angle
  - iv) Power factor
  - v) Power consumed
  - vi) Phasor diagram
- 4 a. Define the following terms : 6
  - i) RMS value
  - ii) Average value
  - iii) Form factor
  - iv) Peak Factor
- b. Show that the current in pure capacitor leads the voltage by  $90^\circ$ . 6
- c. A resistance of  $20 \Omega$  and inductance of 0.2 H and capacitance of  $100 \mu\text{f}$  are connected in series across 220 V, 50 Hz supply. Calculate; 8
  - i) Impedance
  - ii) Current
  - iii) Voltage across each element
  - iv) Power absorbed
  - v) Power factor

**UNIT - III**

- 5 a. Develop the relation between line and phase values for 3- $\phi$  balanced star connected system. 8
- b. Three similar coils each having resistance of 20  $\Omega$  and an inductive reactance of 15  $\Omega$  are connected in delta to a 440 V three phase 50 Hz supply. Determine; 6
- i) The line current            ii) Power factor            iii) Power supplied
- c. Mention the preventive measure should be taken against electric shock, and list out the characteristics of Fuses. 6
- 6 a. What is the necessity of Earthing? With a neat sketch explain Plate earthing. 6
- b. With a neat sketch, explain the construction and working of a single phase induction type energy meter. 7
- c. With the help of a circuit diagram and switching table, explain 2-way and 3-way control of lamps. 7

**UNIT - IV**

- 7 a. With a neat sketch, explain the construction of a DC machine and function of each part. 8
- b. Derive an expression for the torque developed by a DC motor. 6
- c. An 8-pole DC has 500 armature conductors and a useful flux of 0.05 Wb per pole. What will be the *emf* generated, if it is lap-connected and runs at 1200 rpm? What must be the speed at which it is to be driven to produce the same *emf*, if it is wave-wound? 6
- 8 a. What is Back *emf*? Explain its significance. 6
- b. With usual notation, derive an *emf* equation of a synchronous generator. 6
- c. Find the phase and line voltage of a star-connected 3-phase, 6-pole alternator which runs at 1200 rpm, having flux per pole of 0.1 Wb sinusoidally distributed. Its stator has 54 slots having double layer winding. Each coil has 8 turns and the coil is chorded by 1 slot. 8

**UNIT - V**

- 9 a. Obtain an expression for *emf* of a transformer. 6
- b. What is a transformer? Explain the construction of Core type and Shell type transformer. 8
- c. In a 25 kVA, 2000/200 V, single phase transformer, the iron and full-load copper losses are 350 and 400 W respectively. Calculate the efficiency at unity power factor at, 6
- i) Full load            ii) Half full-load
- 10 a. Explain the concept of rotating magnetic field in a three phase induction motor. 8
- b. Explain the concept of slip and its significance in a three phase induction motor. 6
- c. A 10-pole induction motor is supplied by a 6-pole alternator which is driven at 1200 rpm. If the motor runs at a slip of 3%, what is the speed of the induction Motor? 6

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