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

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, B.E. - Semester End Examination; Dec - 2016/ Jan - 2017

Basic Electrical Engineering

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

***Note**: i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Missing data may suitably assume.

UNIT - I

1 a. Determine the value of unknown resistance 'R' and the total current drawn from the source in the circuit shown in Fig. 1(a). Also compute the total power dissipated in the circuit. All resistances are in ohms. 8

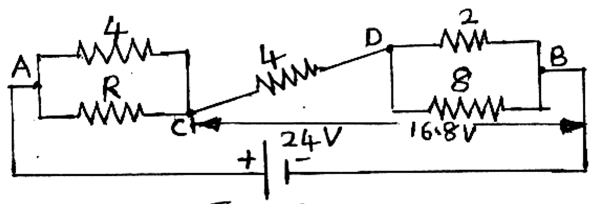

Fig. 1(a)

b. The coil A consists of 1200 turns and another coil B of 800 turns lie near to each other so that 60% of the flux produced in one links the other. It is found that a current of 5 A in coil A produces a flux of 0.25 mwb, while the same current in coil B produces a flux of 0.15 mwb. Determine the mutual inductance and coefficient of coupling between the coils. 6

c. State and explain Faraday's Law of electromagnetic induction. 6

2 a. Derive the expression for coefficient of coupling 'K'. 6

b. A coil consists of 600 turns and a current of 10 A in the coil gives rise to a magnetic flux of 1 milli web. Calculate; 6

(i) The self inductance

(ii) The energy stored

(iii) The emf induced when the current is reversed in 0.01 second.

c. Two batteries A and B are connected in parallel and load of 10 Ω is connected across their terminals. A has an emf of 12 V and internal resistance of 2 Ω. B has an emf of 8 V and an internal resistance of 1 Ω. Use Kirchhoff's Laws to determine the values and directions of the current flowing in each of the batteries and in the external resistance. Also determine the potential difference across the external resistance. 8

UNIT - II

3 a. Derive the expression for RMS and Average value of an alternating quantity. 6

b. Prove that the current in a purely inductive circuit lags behind the applied voltage by 90º. Also write the waveforms. 6

c. An inductive coil is connected in series with a resistance of 50 Ω across a 230 V, 50 Hz, AC supply. The voltage across the coil is 180 V and across the resistance is 130 V. Calculate; 8
(i) The resistance and inductance of the coil
(ii) The power dissipated in the coil. Draw the phasor diagram.

4 a. A 50 Hz sinusoidal voltage $v = 141.4\ sinwt$ V is applied to a series R-L circuit consisting of R = 3 Ω and L = 0.01272 H. Compute; 10
(i) The effective value of the steady state current and its phase angle
(ii) The expression for the instantaneous current
(iii) The effective value and phase angle of the voltage drops across each element.
(iv) The average power and power factor of the circuit.
(v) The reactive power.

b. Two impedances Z_1 = (12+j15) Ω and Z_2 = (8-j4) Ω are connected in parallel. If the potential difference across this combination is (230+j0) V. Calculate; 10
(i) The current supplied to each branch and the total current
(ii) The power factor of each branch and the total power
(iii) The power factor of each branch and the overall power factor.
Also draw the phasor diagram.

UNIT - III

5 a. What are the advantages of 3 phase system over single phase system? 4

b. Each phase of a star connected system consists of a resistance of 100 Ω in parallel with a capacitance of 32 μF. Calculate the line current, the power absorbed, the total kVA and the power factor when connected to a 415 V, 50 Hz, 3-phase supply. 8

c. Explain with a neat diagram, the working of induction type energy meter. 8

6 a. A balanced 3 phase star connected load draws power from a 440 V supply. The two watt meters connected indicate W_1 = 5 kW and W_2 = 1.2 kW. Calculate the power, power factor and current in the circuit. 6

b. With a neat diagram, explain pipe earthing. 6

c. A balanced load takes 20 kVA at a power factor of 0.8 lagging from a 250 V, 50 Hz, 3 phase circuit. Calculate the values of components in the circuit, if the load is delta connected. 4

d. What is the purpose of fuse? What are the requirements of good fuse? 4

UNIT - IV

7 a. With usual notations, derive the emf equation of a d.c. generator. 6

b. Explain why a d.c. series motor is best suited for electric traction? 4

Contd….3

c. A 2 pole 3 phase alternator running at 3000 rpm has 42 slots with 2 conductors per slot. Calculate the Flux per pole required to generate line voltage of 2300 V. Assume $K_d = 0.952$, $K_P = 0.956$. 6

d. Compare salient pole alternator with a cylindrical pole alternator. 4

8 a. The armature of a 4 pole, Lap wound dc shunt generator has 120 slots with 4 conductors per slot. The flux per pole is 0.05 wb. The armature resistance and the shunt field resistances are 0.05 Ω and 50 Ω respectively. Determine the speed of the machine when supplying a load current of 450 A at a terminal voltage of 250 V. 6

b. Why is it necessary to use a starter for starting d.c. motor? 4

c. State the advantages of having stationary armature and rotating field system in large size alternators. Also, is there any harm, if the field is made rotating in a d.c. machine? 6

d. A 12 pole, 3 phase, 500 rpm star connected alternator has 48 slots with 15 conductors per slot. The Flux per pole is 0.02 wb and is distributed sinusoidally. The winding factor is 0.97. Calculate the line emf. 4

UNIT - V

9 a. A single phase 25 kVA, 1000 V/2000 V, 50 Hz transformer has maximum efficiency of 98% at full load U.P.F. Determine its efficiency at, 8

(i) $\frac{3}{4}^{th}$ full load, UPF (ii) $\frac{1}{2}$ full load, 0.8 pf (iii) 1.25 times Full load, 0.9 pf.

b. A single phase transformer has 1000 turns on its primary and 400 turns on the secondary side. An a.c. voltage of 1250 V, 50 Hz is applied on its primary side, with secondary open circuited. Calculate; 4

(i) The secondary emf

(ii) The maximum value of the flux density given that the effective cross-sectional area of the core is 60 cm^2.

c. With the help of vector diagrams, show that the stator, flux in an induction motor has a constant value of 1.5 times the maximum value of the flux due to each phase. 8

10 a. Define slip. Derive an expression for frequency of rotor current. 6

b A 6 pole induction motor is supplied by a 10 pole alternator which is driven at 600 rpm. If the motor is running at 970 rpm, determine the percentage slip. 4

c. Mention and explain the various losses in a transformer. How these losses are minimized? 6

d. Define voltage regulation of a transformer. Does it depend on the load power factor? 4

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