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T 3245

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Second Semester

(Regulation 2004)

Mechanical Engineering

EE 1161 — BASIC ELECTRICAL ENGINEERING

(Common to Aeronautical Engineering/Automobile Engineering and Production Engineering)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. A bulb consumes 60 W on a 240 V DC supply. Find the current passing through the bulb.

2. An alternating voltage is given by $V = 2\sin 314\,t$. Calculate the frequency.

3. What are the characteristics of DC generators?

4. What are the types of rotor construction for synchronous machines?

5. A transformer with 40 turns on HV side is to be used to step down the voltage from 240 V to 120 V. Find the number of turns in the LV side.

6. Draw the equivalent circuit of the transformer referred to low voltage side.

7. What are the types of single phase induction motors?

8. A three phase, four pole induction motor runs at 1440 rpm on a 50 Hz supply. Find the synchronous speed.

9. A moving coil instrument requires 20 mA and 100 mV for full scale deflection. What is the value of the shunt required to be used in the above meter to read upto 10 A.

10. What is meant by 'limiting error' in an instrument?

PART B — (5 × 16 = 80 marks)

11. (a) (i) For the circuit shown below, find V_1 and I_2, using the method of series-parallel combination. (8)
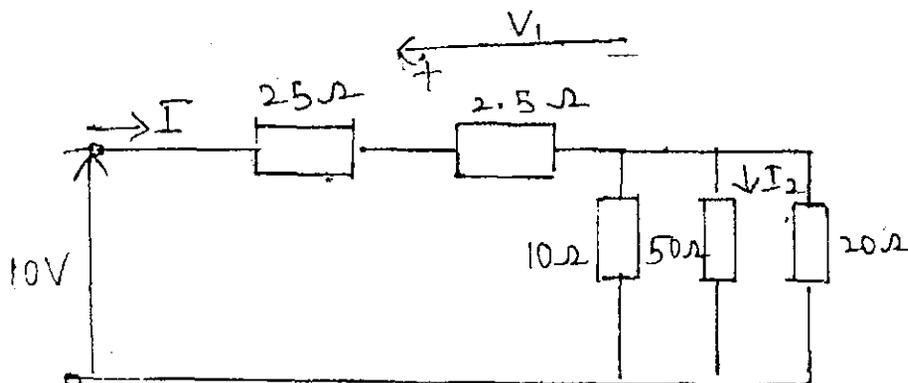

   (ii) A circuit consists of a resistor of 100 Ω, an inductor of 1 H and a capacitor connected in series across a supply of 400 V, 50 Hz. What value of capacitor will be required in order to make the current in the circuit to be 2.5 A? What will be the voltage across the capacitor? (8)

Or

   (b) (i) For the circuit shown below, find the voltage V across 6 Ω resistance using mesh analysis method. (8)
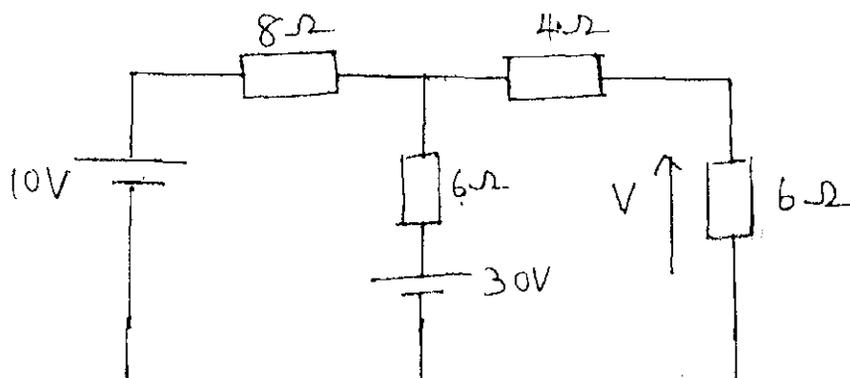
(ii) For the following circuit, find the nodal voltages and the current through 2 Ω resistance. (8)
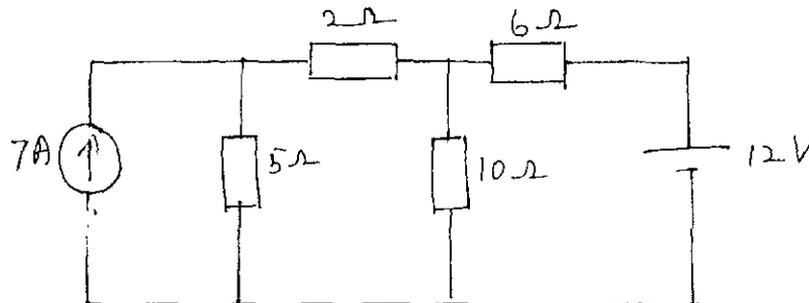
12. (a) (i) Explain the principle of operation of DC generator and derive the emf equation. (8)

(ii) A 6 pole, wave wound armature has 49 slots with 8 conductors per slot. Its useful flux per pole is 20 mWb. At what speed, should the armature be rotated in order to obtain an emf of 500 V? (8)

Or

(b) (i) Explain the principle of operation of synchronous motor. (8)

(ii) A three phase, 50 Hz 4 pole Alternator has a star connected winding with 60 slots and 8 conductors per slot. It is driven at 1500 rpm and the flux per pole is 0.04 Wb, sinusoidally distributed. Find the phase and line voltages. (8)

13. (a) (i) Explain the construction of core type and shell type transformer. (8)

(ii) A transformer supplied a load of 32 A at 415 V. If the primary voltage is 3320 V, find the following :
- Secondary volt ampere
- Primary current
- Primary volt ampere.

Neglect losses and magnetising current. (8)

Or

(b) (i) Draw the four types of 3 phase transformer connections. (8)

(ii) The primary and secondary turns of a transformer are 150 and 75 respectively. The primary is excited at 200 V, 50 Hz, while the secondary is connected to a load impedance of $5 \lfloor 30° \Omega$. Assuming the transformer to be ideal, Calculate the primary and secondary currents, their power factor and the primary and secondary real powers. (8)

T 3245

14. (a) (i) Describe the tests to be performed on an induction motor to determine the circuit parameters. (8)

(ii) A 5 kW, 400 V, 50 Hz, 4 pole induction motor gave the following test data :

no load test : $V_0 = 400$ V , $P_0 = 350$ W , $I_0 = 3.1$ A

blocked rotor test : $V_{sc} = 52$ V , $P_{sc} = 440$ W , $I_{sc} = 7.6$ A

A 24 V dc when applied between two stator terminals, causes a current of 7.6 A to flow. Calculate the motor efficiency at the rated voltage at a slip of 4%.. (8)

Or

(b) (i) Explain the principle of operation of single phase induction motor and describe various starting methods of the same. (8)

(ii) A three phase, 20 kW, 4 pole 50 Hz, 1440 rpm induction motor delivers power to a mechanical load. The windage and friction loss of motor is 1500 W. Determine the mechanical power developed, power across the air-gap, and rotor copper loss. (8)

15. (a) (i) Explain and derive the torques operating on the moving system of an instrument. (8)

(ii) Explain the principle of working of permanent magnet type, moving coil instruments. (8)

Or

(b) (i) Describe the working of moving iron type instruments. (8)

(ii) A moving coil instrument has 50 Ω coil resistance and gives maximum deflection at 5 mA. Find the external resistance to be connected with the instrument so as to read upto 300 V. (6)

(iii) State various types of errors in meaning instruments. (2)

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