Code : 100101

B.Tech 1st Semester Exam., 2018 (New)

BASIC ELECTRICAL ENGINEERING

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Answer any *seven* short answer-type questions : 2×7=14

(a) Introduce resistance, inductance and capacitance.

(b) State superposition theorem.

(c) A sinusoidal voltage of 60 Hz has a maximum value of $100\sqrt{2}$ volts. At what time measured from a positive maximum value will the instantaneous voltage be 100 volts?

(d) What are the two main advantages of DC excitation system?

(e) In two-wattmeter method, what will be the power factor when both wattmeters show 50 watts readings?

(f) Explain power triangle.

(g) How do hysteresis and eddy current loss depend on frequency?

(h) Define average value and RMS value.

(i) Explain generation of rotating magnetic field in electrical machine.

(j) Differentiate among neutral, grounding and earthing.

2. *(a)* Find R to have maximum power transfer in the circuit shown in Fig. 1. Also obtain the amount of maximum power : 6

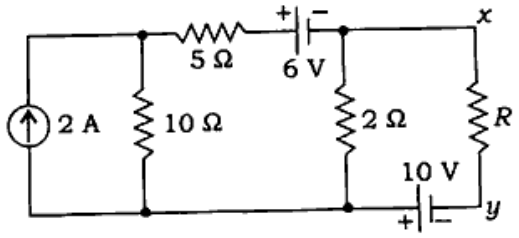

Fig. 1

(b) A coil having resistance of 10 Ω and inductance of 1 H is switched on to a direct voltage of 100 V. Calculate the rate of change of the current (i) at the instant of closing the switch and (ii) when $t = L/R$. Also find the steady-state value of the current. 8

3. (a) What is the phase relationship between R, L and C components in a series AC circuit? What are active power, reactive power and apparent power? 6

(b) On a power distribution system, three loads run in parallel :

Load A : 100 VA, 0·5 pf (lag)

Load B : 150 W, 0·8 pf (lead)

Load C : 200 VA, 100 var (lag)

Find the net power position. 8

4. (a) What is eddy-current loss? What are the undesirable effects of eddy currents? How can they be minimized? Mention some applications of eddy-currents. 6

(b) An iron ring of cross-sectional area 5 cm^2 is wound with a wire of 120 turns and has a cut of 3 mm. Calculate the magnetizing current required to produce a flux of 0·3 m Wb, if mean length of magnetic path is 25 cm and relative permeability of iron is 650. 8

5. (a) Define voltage regulation of a transformer and derive conditions for (i) zero regulation and (ii) maximum regulation. Also draw the curve of variation of voltage regulation with power factor. 6

(b) Derive an expression for the induced e.m.f. of a transformer. A 3000/200 V, 50 Hz, single-phase transformer is built on a core having an effective cross-sectional area of 150 cm^2 and has 80 turns in the low-voltage winding. Calculate—

(i) the value of the maximum flux density in the core;

(ii) the number of turns in the high-voltage winding. 8

6. The circuit shown in Fig. 2*(i)* is the Thevenin equivalent circuit of the circuit shown in Fig. 2*(ii)*. Find the value of the open circuit voltage, V_{oc} and Thevenin resistance, R_{th}. 14

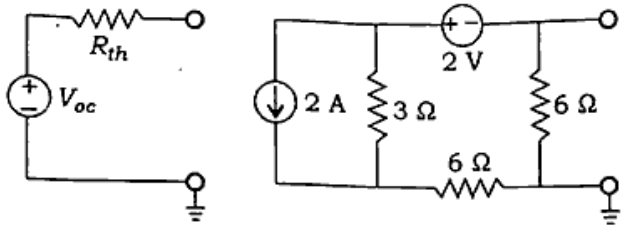

Fig. 2 *(i)* Fig. 2 *(ii)*

7. Determine current in 12 Ω resistance using Norton's theorem in the network shown in Fig. 3 : 14

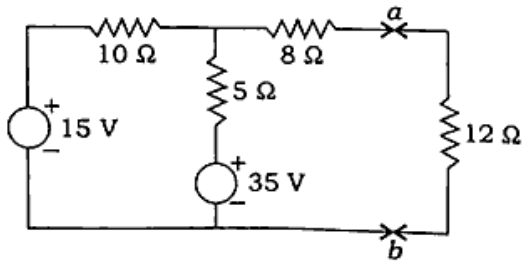

Fig. 3

8. A 100 MVA Y-connected 13·2 kV synchronous generator is connected to a 13·2/132 kV, 100 MVA delta-star transformer. The generators are $X''_d = 0{\cdot}1$ pu, $X'_d = 0{\cdot}25$ pu, $X_d = 1{\cdot}2$ pu on a 100 MVA base, while transformer reactance is 0·1 pu on the same base. The machine is operating on no load, at rated voltage when a three-phase fault occurs at the HT terminals of transformer. Determine—

(a) the sub-transient, transient and steady-state symmetrical fault currents in pu and amperes;

(b) the maximum possible DC component;

(c) the maximum value of instantaneous current. 14

9. *(a)* Derive the expressions of equivalent star network resistances from the delta network comprising of R_{12}, R_{23}, R_{31}, where nodes are termed as 1, 2 and 3 respectively. 7

(b) What is the main purpose of providing taps in transformer? Suggest the addition in a simplified transformer model when it is used for tap changing transformer. 7

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