

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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[4756]-14

F.E. (First Semester) EXAMINATION, 2015

BASIC ELECTRICAL ENGINEERING

(2008 PATTERN)

Time : Three Hours

Maximum Marks : 100

N.B. :— (i) Answers to the two Sections should be written in separate answer-books.

(ii) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12.

(iii) Figures to the right indicate full marks.

(iv) Neat diagrams must be drawn wherever necessary.

(v) Use of non-programmable pocket size scientific calculator is permitted.

(vi) Assume suitable additional data if necessary.

Section I

1. (a) What is insulation resistance ? State its unit and obtain an expression for insulation resistance of cable. [8]

(b) Explain lead-acid battery with respect of construction and maintenance. [8]

P.T.O.

Or

2. (a) A resistance element having cross-sectional area of 10 mm^2 and length of 10 m takes a current of 4A from 200 V supply at temperature of 25°C . Find : [10]

(i) Resistivity of material

(ii) Current it will take when temp rises to 75°C .

Assume $\alpha_{25} = 0.0003/^\circ\text{C}$

- (b) Explain the following terms with respect to electrical : [6]

(i) Energy

(ii) Power.

3. (a) Derive an expression to convert star-connected network into its equivalent delta connected network. [8]

- (b) State and explain the following laws : [8]

(i) KCL

(ii) KVL.

Or

4. (a) Explain the following terms with reference to D.C. resistive network : [8]

(i) Unilateral and bilateral network

- (ii) Linear and non-linear network
 - (iii) Lumped and distributed network
 - (iv) Active and passive network.
- (b) State and explain superposition theorem. [8]
5. (a) Compare electrical and magnetic circuits : [10]
- (b) Define the following terms and state its units : [8]
- (i) Magnetic flux
 - (ii) Flux density
 - (iii) Permeability of free space
 - (iv) Reluctance.

Or

6. (a) A coil of 2000 turns is wound uniformly over non-magnetic ring of mean circumference of 80 cm and cross-sectional area of 0.6 cm^2 , if the current through the coil is 2A. Calculate : [8]
- (i) Magnetising force
 - (ii) Reluctance
 - (iii) Total flux
 - (iv) Flux density.

- (b) Derive an expression for the energy stored in magnetic field in terms of energy stored per unit volume. [10]

7. (a) Define with respect to alternating quantity : [8]

(i) Instantaneous value

(ii) Periodic time

(iii) Frequency

(iv) Time period.

- (b) Prove that average value of sinusoidal alternating current is 0.637 times its maximum value. [8]

Or

8. (a) Find the resultant of three voltages given by : [8]

$$V_1 = 10 \sin \omega t, V_2 = 20 \sin (\omega t / \pi / 4), V_3 = 30 \cos (\omega t + \pi / 6)$$

- (b) Derive an expression for energy stored in a capacitor. [8]

9. (a) Define and explain the following terms : [8]

(i) Active power

(ii) Reactive power

(iii) Impedance

(iv) Admittance.

(b) A circuit consisting of a resistance of $20\ \Omega$ and inductance of $0.1\ \text{H}$ is connected in series across single-phase $200\ \text{V}$, $50\ \text{Hz}$ supply. Calculate : [8]

(i) Current drawn

(ii) Power consumed.

Or

10. (a) A sinusoidal voltage $v = V_m \sin \omega t$ is applied across a series R-C circuit. Derive an expression for current and average power consumed by a circuit. [8]

(b) A resistance of $25\ \Omega$, inductance of $64\ \text{mH}$ and capacitor of $80\ \mu\text{F}$ are connected in series across $110\ \text{V}$, $50\ \text{Hz}$ single-phase a.c. supply. Calculate the current, voltage across individual element and overall power factor of the circuit. [8]

11. (a) Write short notes on : [10]

(i) Losses taking place in a transformer;

(ii) Autotransformer.

(b) A 500 kVA transformer has iron losses 2 kW and full load copper losses of 5 kW. Calculate : [8]

(i) Efficiency at 75% of full load, unity power factors

(ii) Efficiency at full load, 0.8 power factor lag.

Or

12. (a) Differentiate between core type and shell type of transformer. [8]

(b) Define the following terms related to three-phase circuit : [10]

(i) Symmetrical system

(ii) Phase sequence

(iii) Balanced load

(iv) Unbalanced load.