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F.E. EXAMINATION, 2016  
BASIC ELECTRICAL ENGINEERING  
(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.** :- (i) Figures to the right indicate full marks.  
(ii) Neat diagrams must be drawn wherever necessary.  
(iii) Use of Logarithmic tables, slide rule, Mollier charts and steam tables is allowed.  
(iv) Use of programmable calculators is not allowed.  
(v) Assume suitable data if necessary.
1. (a) If  $\alpha_1$  and  $\alpha_2$  are RTC's of material at  $t_1$  °C and  $t_2$  °C respectively, then prove that,  $\alpha_1 / \alpha_2 = 1 + \alpha(t_2 - t_1)$ . [6]  
(b) An electric kettle is required to raise the temperature of 2 litres of water from 20°C to 100°C in 15 mins. Calculate the resistance of the heating element if the kettle is to be used on 200 V supply. Assume efficiency of the kettle to be 80%. Assume specific heat of water of 4180 J/kg-K. [6]  
*Or*
2. (a) Compare magnetic circuit and electric circuit. [6]  
(b) A coil of 600 turns and of resistance of 20  $\Omega$  is wound uniformly over a steel ring of mean circumference of 30 cm and cross-sectional area of 9 cm<sup>2</sup>. It is connected to a supply of 20 V. If the relative permeability of a ring is 1600, find :  
(a) the reluctance  
(b) the magnetic field intensity  
(c) the mmf and  
(d) the flux. [6]

3. (a) What is an Autotransformer ? State the different advantages and applications of an Autotransformer. [6]  
(b) Find the expression for current which will flow when a pure inductor of 0.2H is connected across 230 V, 50 Hz, AC supply. Draw the phasor daigram. [6]  
*Or*
4. (a) Define average value of alternating quantity and derive its expression for sinusoidal current. [6]  
(b) A 3300/110 V, 50 Hz, 50 kVA transformer has full load copper load of 1600 watts and iron loss of 1800 watts. Estimate the transformer efficiency at :  
(i) full load and 0.7 lagging pf  
(ii) half load and 0.85 lagging pf. [6]
5. (a) Three coils, each having a resistance of 20  $\Omega$  and an inductance of 15  $\Omega$  are connected in star to a 400 V, 3-phase, 50 Hz supply. Calculate :  
(i) The line current  
(ii) Power factor and  
(iii) Power supplied. [6]  
(b) A sinusoidal voltage  $v = V_m \sin \omega t$  is applied across the series R-L circuit. Derive the expression for average power consumed by the circuit. Also draw waveform of power consumed in it. [7]  
*Or*
6. (a) Derive the relationship between the line current and phase current, line voltage and phase voltage, for a balanced three phase star connected load across three phase supply. Derive power consumed by 3-phase balanced star connected load. [7]

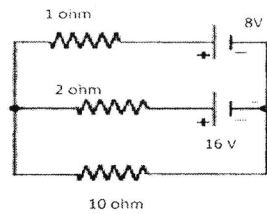
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- (b) A coil having resistance of  $7\Omega$  and an inductance of  $31.8\text{ m H}$  is connected to  $230\text{V}$ ,  $50\text{ Hz}$  supply. Calculate :
- the circuit current
  - phase angle
  - power factor
  - power consumed
  - voltage drop across resistance and inductor. [6]

7. (a) Derive formula to convert STAR connected network into its equivalent DELTA circuit. [6]
- (b) Apply Kirchhoff's law to calculate current drawn by  $10\Omega$  resistance for the circuit. [7]



Or

8. (a) State and explain Superposition theorem as applied to simple DC circuit. [6]
- (b) Apply Thevenin's theorem to calculate current flowing in  $5\Omega$  resistance for the network. [7]

