1. Attempt any four parts of the following: 5×4=20

(a) Define magnetic leakage coefficient. Draw hysteresis loop for a magnetic material. Explain its importance.

(b) An electromagnet shown in Fig. 1 has c.s. area of 12 cm². Mean length of iron path is 50 cm, length of air gap is 0.4 cm. It is excited by two coils of 400 turns each at 1A. \( \mu_x \) for material is 1300. Calculate:

(i) Reluctance of magnetic ckt
(ii) Reluctance of air gap
(iii) Total Reluctance
(iv) Total \( \Phi \)
(v) Flux density of air gap

![Fig. 1]
(c) Define series resonance. What is quality factor? Derive an expression for 'Q' in terms of R, L, C of a ckt.

(d) The voltage and current of an R-L-C series ckt are: 

\[ v = 141.4 \sin(314t + 45^\circ)V, \]

\[ i = 28.28 \sin(314t - 15^\circ)A. \] 
Find:

(i) \( \text{rms V, I} \)
(ii) \( \text{power factor} \)
(iii) \( \text{power consumption} \)
(iv) \( \text{time period} \)
(v) \( \text{resistance in a ckt.} \)

(e) In a ckt, shown in Fig. 2, \( U = 100 \sin 3t \) is applied. Find:

(i) \( \text{currents } I_1 \text{ and } I_2 \text{ with their phase angles.} \)
(ii) \( \text{total current } I \)
(iii) \( \text{phase angle } \phi \text{ of current } I. \)

(f) Define \( \text{rms value for sinusoidal supply.} \) Develop a relationship between \( I_{\text{rms}} \) and \( I_{\text{maximum}} \).

2 Attempt any \textbf{four} parts of the following: \( 5 \times 4 = 20 \)

(a) In \( Y - \Delta \) transformation, obtain equivalent \( \Delta \) of \( Y. \)

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(b) Define Thevenin's theorem. Find $V_{th}$ and $R_{th}$ for a ckt shown in Fig. 3.

![Fig. 3](image)

(c) Find current in 4 $\Omega$ resistor for a ckt. shown in Fig. 4. Find the value of $R$.

![Fig. 4](image)

(d) Find current $I$ in 8 $\Omega$ resistance using superposition theorem. Fig. 5

![Fig. 5](image)

(e) Define maximum power transfer theorem. Explain with an example.

(f) Explain attraction type moving iron instrument with neat and clean diagram.

3 Attempt any two parts of the following: $2 \times 10 = 20$

(a) Explain two wattmeter method for measuring three phase power for Y-connected ckt. Determine phase angle in terms of wattmeter readings.
(b) Explain O/C and S/C tests on 1–φ transformer. Determine parameters on transformer using these tests. Draw equivalent ckt. of transformer.

(c) A balanced Y-connected load is connected from symmetrical 3–φ, 400 V supply system. The current in each phase is 30 A with lagging power factor at 30°. Find:
   (i) Impedance in each phase
   (ii) Total power drawn
   (iii) Draw phasor diagrams

4 Attempt any two parts of the following: 2×10=20

(a) Calculate flux/pole required for 4-pole generator with 360 conductors generating 250 V at 1000 rpm, when (i) armature is lap wound (ii) armature is wave wound.

(b) Explain the working principle of synchronous motor with neat and clean diagram. Explain its applications.

5 Attempt any two questions:

(a) Explain the star-delta starter operation for speed control of three phase induction motor. Draw its neat and clean diagram.

(b) 1–φ induction motor is not a self starting motor, why? Explain the methods to make it self start.

(c) Explain the principle of operation of a three phase induction motor with neat and clean diagrams. Give its applications.