3 Hours/100 Marks   Seat No. ☐☐☐☐☐☐☐☐

Instructions : (1) **All** questions are **compulsory**.

(2) Answer **each** next main question on a **new** page.

(3) Illustrate your answers with **neat** sketches **wherever** necessary.

(4) Figures to the **right** indicate **full** marks.

(5) Assume suitable data, if **necessary**.

(6) Use of Non-programmable Electronic Pocket Calculator is **permissible**.

(7) Mobile Phone, Pager and any other Electronic Communication devices are **not permissible** in Examination Hall.

MARKS

1. Attempt **any ten** :   **20**

   a) Write definition and formula of power factor.

   b) State any two disadvantages of low power factor in supply system.

   c) Write the formula of 3-phase power and relation between line voltage and phase voltage in 3φ star connected system.

   d) Define resonance in series R-L-C circuit and write the formula of resonance frequency.

   e) Define and write formula of
      I) Slip
      II) Synchronous speed

   f) State the E.M.F. equation of transformer and write meaning of each term in the formula.

   g) State the Faraday's laws of electromegnetic induction.

   h) List any two applications of
      I) Stepper motor
      II) Servo motor

P.T.O.

   i) Define :
      I) Minimum fusing current
      II) Fusing factor.

   j) Write the full form of following
      I) ELCB   II) MCB
      III) MCCB   IV) HRC (Fuse)

   k) Define :
      I) % regulation
      II) % efficiency of transformer and write formula for it.

   l) What will happen if transformer is connected to DC supply ?

   m) How the direction of 3 phase induction motor can be reversed ?

   n) Draw only a circuit diagram and phasor diagram of an ac R-L series circuit.

2. Attempt **any four** :   **16**

   a) What are effects of change in frequency on inductive and capacitive reactance ? Also write the formula for X_L and X_C.

   b) Why single phase motors are not self starting ? How it is made self starting ?

   c) What is earthing ? Draw only schematic diagram of pipe earthing.

   d) Define :
      I) Cycle
      II) Frequency
      III) Time period
      IV) Amplitude of AC voltage

   e) Three impedances each of 3-ohm resistance and 5-ohm-reactance in series are connected in star across 50 Hz, 440 volt line voltage. Find
      I) Impedance   II) Phase current
      III) Power factor   IV) Total power

   f) Compare 3ϕ slip ring motor and squirrel cage motor based on following point
      I) Construction and cost
      II) Starting torque
      III) Power factor and efficiency
      IV) Methods of starting.

MARKS

3. Attempt **any four** : 16

a) Why the core of a transformer is laminated ? Write only the names of losses in transformer and method to reduce the losses.

b) Write any two applications of
   I) Pulse transformer
   II) Auto transformer
   III) Audio tranformer
   IV) Intermediate frequency transformer.

c) List out the speed control methods for 3 phase induction motor. Explain any one with neat sketches.

d) Draw neat sketch and write working principle of shaded pole single phase motor.

e) Compare single phase and three phase system on the basis of following point
   I) Output II) Efficiency
   III) Cost IV) Power factor

f) For a given equation of voltage and current in a circuit $v = Vm \sin \omega t$, $i = Im \sin (\omega t + 90°)$.

   State what type of circuit is it. Draw wave form of voltage, current and power in the circuit.

4. Attempt **any four** : 16

a) What is the principle of 3 phase E.M.F. generation ? Draw its wave form.

b) An alternating voltage is given as $e = 250 \sin 314.16 \, t$ than find
   I) R.M.S. value
   II) Maximum value
   III) Frequency
   IV) Value of voltage at $t = 05$ ms.

c) Define dynamically induced EMF and explain principle of mutually induced EMF.

d) Define alternating current and write any three advantages of AC over DC voltage.

e) What is auto transformer ? Write any three applications of auto transformer.

f) Draw only circuit diagram of a single phase capacitor start induction run motor. What is the use of centrifugal switch ? And write any one application of it.

5. Attempt **any four** :   **16**

   a) What is meant by a 3 phase balanced and unbalanced load ?

   b) Define the following term as related to AC supplies
      I) Form factor   II) Peak factor
      III) Q-factor   IV) Impedance

   c) Write any four factors upon which an inductance of a coil depends.

   d) Write the property of ideal transformer and also write the formula for transformation ratio.

   e) Explain with neat sketch working principle of universal motor.

   f) Compare series and parallel resonance circuits (any four points).

6. Attempt **any four** :   **16**

   a) Explain in brief the construction and working principle of 3-phase induction motor.

   b) Write the symbol and unit of following :
      I) Magnetic flux density
      II) Magnetic field strength
      III) Reluctance
      IV) Co-efficient of self inductance

   c) Draw neat sketch and write working principle of direct online starter for small squirrel cage induction motor.

   d) Write any four applications of
      I) 3-phase slipring induction motor
      II) Squirrel cage induction motor

   e) Define active, reactive and apparent power in AC circuit. Write the unit of each power and draw power triangle for an inductive load.

   f) Write any two general precautions while using electrical energy. Define lagging power factor and leading power factor.

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