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13141

3 Hours / 100 Marks

Seat No.

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- 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. a) **Attempt any SIX of the following:** **12**
- i) Draw the waveforms of voltage and current of pure capacitive circuit.
- ii) Draw the impedance triangle of a R-C series circuit.
- iii) Write any two advantages of polyphase circuit.
- iv) Draw the voltage waveform of a 3 phase a.c. supply w.r.t. time.
- v) Write down the equation to find out the active power in 3-phase system and reactive power in 3 phase circuit.

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- vi) Define : Synchronous speed and slip speed in 3 phase IM.
- vii) Draw a neat diagram showing different parts of their phase induction motor.
- viii) Write any four safety precautions while working with electrical system.

b) **Attempt any TWO of the following:** **08**

- i) Explain the concept of lagging and leading by waveform and mathematical equation in AC circuit.
- ii) Compare electric circuit and magnetic circuit on any four points.
- iii) Explain working principle of servo motor. Mention different types and any two applications.

2. **Attempt any FOUR of the following:** **16**

- a) Draw the waveforms and phasor diagram to show the phase relationship between voltage and current in pure inductive and pure capacitive circuit.
- b) What is power factor? State its significance. What is the condition for unity power factor?
- c) Explain generation of single phase a.c. supply by elementary alternator.
- d) Equation for current and voltage in a circuit are given by :
 $V = V_m \sin \omega t$, $i = I_m \sin (\omega t + 60)$
State what type of circuit it is? Draw waveform of voltage and current and power in the circuit.

- e) Draw a neat circuit diagram of three phase delta connected system and write relationship between
 - i) Line voltage and phase voltage.
 - ii) Line current and phase current
- f) Give classification of transformers on any two point. What is KVA rating of transformer?

3. Attempt any **FOUR** of the following:

16

- a) Define :
 - i) Inductive reactance
 - ii) Capacitive reactance
 - iii) Impedance
 - iv) Power factor
- b) What is the phenomenon of resonance in R-L-C parallel circuit? Define Q factor of parallel circuit.
- c) If a.c. current is represented by equation $i = 25 \sin (314t)$. Calculate rms value, average value, frequency and time period of current.
- d) Explain the following terms :
 - i) Induced emf
 - ii) Dynamically induced emf
 - iii) Statically induced emf.
- e) State and explain Faraday's laws of electromagnetic induction and its two application in electrical engineering.
- f) Explain voltage ratio, current ratio and transformation ratio of a transformer with neat sketch.

4. Attempt any FOUR of the following: 16

- a) A circuit consist of a resistance of 4Ω and inductance of 0.5 H and variable capacitance in series across a 100V , 50Hz supply. Calculate.
- the value of capacitance to produce resonance
 - the voltage across the capacitance
 - the Q-factor of the circuit.
- b) State specification and two applications of isolation transformer and power transformer.
- c) Write any four difference between slipring induction motor and squirrel cage induction motor.
- d) Explain the working principle of an induction motor.
- e) Explain the effect of change in rotor resistance on starting torque and maximum torque of induction motor.
- f) Explain working of a stepper motor.

5. Attempt any FOUR of the following: 16

- a) A series R-L. circuit takes a current of 2.7 A when connected to 240V , 50Hz , ac supply and consumes 350 watts . Calculate resistance, inductance, impedance and power factor.
- b) Three impedances of $(8+j6)$ ohms each are connected in star to 3 phase, 440V , 50Hz , balance a.c. supply. Calculate line and phase values of voltages and currents, power, power factor and phase angle between voltage and current.
- c) A $2000\text{V} / 200\text{V}$, single phase 50Hz , transformer has a maximum flux of 20 mwb . Find out the number of turns on primary and secondary winding if cross sectional area of the core is 1.1 cm^2 .

- d) Explain necessity of starter in induction motor. State any four starters used in 3 phase induction motor.
- e) Explain V/f speed control method of 3 phase induction motor in brief.
- f) Explain working of universal motor.

6. Attempt any FOUR of the following:

16

- a) A balanced 3 phase load of 3 kw at a power factor 0.8 lagging is connected across a 3 phase supply. If the line current is 10 Amp. Calculate the resistance and reactance of each branch of star connected load.
 - b) A 3300/200V, 100 KVA, single phase transformer has 80 turns on secondary winding. Calculate current in both winding, flux and primary turns.
 - c) A 3KVA, 230/115V, 50Hz, single phase transformer has following losses.
Constant loss = 100 watts, variable loss = 350 watts.
Calculate : full load efficiency at 0.8 p.f. lagging.
 - d) Compare universal motor with servo motor on the following basis : construction, size, cost, torque, developed, application.
 - e) Explain the working principle of single phase induction motor.
 - f) State and explain the types of wires used in electrical installation.
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