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24225

3 Hours / 70 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. Attempt any FIVE of the following :** **10**
- a) State basic motor principle.
 - b) State Fleming's left hand rule.
 - c) Define : Transformer.
 - d) Distinguish clearly between Yoke and Limb.
 - e) Define : Harmonics. State one effect of harmonics on transformer.
 - f) Define : K factor of transformer.
 - g) State the secondary current rating of CT and secondary voltage rating of PT.

P.T.O.

2. Attempt any THREE of the following : 12

- a) Draw cut-sectional view of DC motor and show yoke, armature winding, brush and commutator on it.
- b) State function and material of following components of DC machine :
 - i) Yoke
 - ii) Pole shoe
 - iii) Commutator
 - iv) Armature winding
- c) Why the emf induced in armature winding of DC motor is called “Back emf”? Explain the significance of back emf.
- d) Suggest suitable method of control speed of D.C. shunt motor above normal or rated speed. Explain this speed control method with governing equation, circuit diagram and speed control characteristic.

3. Attempt any THREE of the following : 12

- a) Explain why starter is necessary for DC motor.
- b) Compare core type and shell type transformer on any four points.
- c) A 3000/250 V, 50 Hz single phase transformer is built on a core having an effective cross sectional area of 125 cm^2 and 70 turns on the low voltage winding
calculate :
 - i) The value of maximum flux density
 - ii) Number of turns on high voltage windings.
- d) A 2KVA, 230V/115V, 50 Hz single-phase transformer takes 0.8A and 200W on no-load from 230V supply mains.
Calculate –
 - i) Iron loss
 - ii) Active or loss component of no-load current.
 - iii) Magnetizing component of no-load current.
 - iv) No-load power factor.

4. Attempt any THREE of the following :**12**

- a) Compare bank of three single-phase transformers with single three-phase transformer on the basis of –
 - i) No. of units
 - ii) Size and weight
 - iii) Cost
 - iv) Maintenance
- b) What is the purpose of polarity test ? Explain with neat diagram, how is it conducted on transformer?
- c) Draw neat circuit diagram and explain suitable transformer connection for three-phase to two-phase conversion.
- d) A 20 KVA, 2000V/200V, single-phase, 50 Hz transformer has a primary resistance of 3.5Ω and reactance of 4.5Ω . The secondary resistance and reactance are 0.015Ω and 0.02Ω respectively. Find –
 - i) Equivalent resistance, reactance and impedance referred to the primary side.
 - ii) Total Cu loss in the transformer.
- e) Explain the working of the pulse transformer and name two applications for the same.

5. Attempt any TWO of the following :**12**

- a) Draw a neat sketch of three point starter for DC shunt motor. Explain its operation during starting. Explain the functions of No-volt coil (NVC) and Over-load coil (OLC).
- b) Explain three cooling techniques employed for power transformers.
- c) Compare distribution transformers with power transformers on the basis of –
 - i) Rating
 - ii) Location in distribution system.
 - iii) Design aspect regarding efficiency.

6. Attempt any TWO of the following :**12**

- a) A 20 KVA, 250/2500 V, 50 Hz, 1 ϕ transformer gave following test results :

OC Test (LV side) : 250 V, 1.4 A, 105 W

SC Test (HV side) : 120 V, 8 A, 320 W

Find the parameters and draw the equivalent circuit of the transformer referred to :

- i) LV side
 - ii) HV side
- b) Explain how to recommend distribution transformer based on its specifications for industrial use as per IS : 1180 (part I) – 1989.
- c) A 50 KVA transformer has its maximum efficiency of 98% at full-load and unity pf. During the day, it is loaded as follows :
- 12 hrs. – 10 KW at a pf of 0.5 lag.
 - 6 hrs. – 25 KW at a pf of 0.9 lag.
 - 6 hrs. – 35 KW at a pf of 0.8 lag.
- Calculate the “all-day efficiency” of the transformer.
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