

17415

21314

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

**Marks**

1. **Attempt any TEN of the following:** **20**
- a) Give the classification of dc generator based on their winding connections.
- b) State the function of armature winding and name the material used for its construction.
- c) State Fleming's Left Hand Rule.
- d) List the various losses in a d.c. motor.
- e) Draw labelled schematic circuit diagram of long shunt compound motor, showing clearly the directions of all the currents.

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- f) State the need of starter in a dc motor.
- g) State any two characteristics of a shell type transformer.
- h) Define the following terms related to single phase transformer:
  - i) Transformation Ratio
  - ii) Turns Ratio
- i) State reason why the rating of the transformer is in KVA and not in KW?
- j) State any two necessary conditions required to be satisfied in order to ensure successful parallel operation of single phase transformers.
- k) Give any two advantages of open delta connection of 3- $\phi$  transformer.
- l) Compare a bank of three single phase transformers with three phase transformer based on the following parameters :
  - i) Number of cores
  - ii) Space occupied
  - iii) Weight
  - iv) If one phase is inoperative

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

- a) Compare lap winding and wave winding on the basis of :
  - i) Number of parallel paths in the winding
  - ii) Voltage generating capability
  - iii) Current sourcing capability
  - iv) Number of brush sets.

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- b) An 8 pole armature has 96 slots with 8 conductors per slot. It is driven at 600 rpm. The useful flux per pole is 10 m Wb. Calculate the induced emf in armature winding when it is :
- lap connected
  - wave connected.
- c) Draw and explain the following characteristics of dc shunt motor :
- Torque Vs Armature current characteristic
  - Speed Vs Torque characteristic
- d) Describe the flux control method using field diverter method for speed control of dc series motor with the help of neat diagram.
- e) A dc shunt motor takes an armature current of 120A from 400V supply and runs at 800 rpm. Calculate armature current and motor speed when magnetic field is reduced to 80% of its initial value. Armature resistance is  $0.25\Omega$  and given that torque developed remains the same.
- f) With the help of necessary sketch, explain in brief the working of brushless DC motor.

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

**16**

- Draw diagram of a core type 1- $\phi$  transformer showing its constructional details. Also state any two characteristics of this transformer.
- The no load current of a transformer is 15 Amp at 0.2 pf when connected to a 460V, 50Hz supply. If the primary winding has 550 turns, Calculate :
  - Magnetising component
  - Core loss component of no load current
  - Maximum flux

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- c) Describe any two methods for transformer cooling.
- d) Derive the emf equation of a transformer.
- e) Draw the complete phasor diagram of a transformer at a load of 0.8 pf lagging.
- f) A single phase 100 KVA; 3.3KV/230V, 50Hz transformer has 89.5% efficiency at 0.85 lagging pf both at full load and also at half load. Calculate the iron loss and full load copper loss.

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

**16**

- a) A 20 KVA, 1000/250V, 50Hz, 1- $\phi$  transformer gave the following test results :  
 OC Test (with LV open) : 1000V, 2A, 250W  
 SC Test (with HV shorted) : 5V, 50 Amp, 200W  
 Calculate the efficiency of this transformer at half full load 0.8 p.f. lagging.
- b) A 30 KVA, 2400/120V, 50Hz transformer has hv winding resistance of  $0.1\Omega$  and leakage reactance of  $0.22\Omega$ . The lv winding resistance is  $0.035\Omega$  and the leakage reactance is  $0.012\Omega$ . Find the equivalent impedance referred to
  - i) hv side
  - ii) lv side
- c) State the different types of losses occurring in a single phase transformer and suggest remedies to minimize these losses.
- d) A single phase transformer with a ratio of 500/200V takes a no load current of 3 Amp at 0.4 pf lag. If the secondary supplies a current of 50 Amp at a pf of 0.85 lag, estimate the current taken by the primary.

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- e) Draw and explain the circuit diagram to carry out polarity test on single phase transformer.
- f) Draw the experimental set up to perform OC and SC Test on a 1KVA, 1- $\phi$ , 50Hz, 230/115V transformer. Select the range of instruments used.

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

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- a) With necessary diagrams, show the derivation for division of load between two transformers with equal voltage ratios connected in parallel.
- b) For a 1000KVA transformer, the full load copper and iron losses are 9 KW and 7 KW respectively. During a day of 24 hours; it is loaded as follows :-

	No of hours	Loading	Pf
1)	6	800 KW	0.8
2)	10	600 KW	0.75
3)	4	200 KW	2.8
4)	4	0	—

Calculate the all day efficiency.

- c) Two 1-phase transformers with equal turns have impedances of  $(0.5 + j3)$  ohm and  $(0.6 + j10)$  ohm with respect to secondary. If they operate in parallel, determine how they will share a load of total 100 KW at pf of 0.8 lagging?
- d) For Delta-star connection of 3 phase Transformers :-
- Draw the connection diagram.
  - List any two advantages of this connection
  - State its area of application.

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- e) Draw the vector diagram and calculate its phase shift for the following vector group :
- i)  $Dy_5$
  - ii)  $Dd_6$
- f) Compare Power Transformer and Distribution Transformer based on the following parameters :
- i) Typical voltages
  - ii) Power rating
  - iii) Maximum efficiency
  - iv) Type of efficiency.

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

**16**

- a) State what is the significance of conducting phasing out test on a 3-phase transformer? Explain its procedure with a suitable connection diagram.
  - b) Describe with neat circuit diagram the method of measurement of power in a high voltage, high current a.c. circuit.
  - c) Explain why a C.T. should never be operated with an open secondary?
  - d) Describe any two functions of Isolation transformer.
  - e) Give any three features and any two applications of welding transformer.
  - f) With proper derivation, show how copper saving is obtained in auto transformer.
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