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

Marks

1.   **Attempt any <u>TEN</u> 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.

Marks

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-φ 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 <u>FOUR</u> 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.

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 :

   i)   lap connected

   ii) wave connected.

c) Draw and explain the following characteristics of dc shunt motor :

   i)   Torque Vs Armature current characteristic

   ii) 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 0.25Ω 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 <u>FOUR</u> of the following:**   **16**

   a) Draw diagram of a core type 1-ϕ transformer showing its constructional details. Also state any two characteristics of this transformer.

   b) 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 :

   i)   Magnetising component

   ii) Core loss component of no load current

   iii) Maximum flux

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-ϕ 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 0.1Ω and leakage reactance of 0.22Ω. The lv winding resistance is 0.035Ω and the leakage reactance is 0.012Ω. 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.

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-φ, 50Hz, 230/115V transformer. Select the range of instruments used.

5. **Attempt any <u>FOUR</u> of the following:** 16

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 :-

i) Draw the connection diagram.

ii) List any two advantages of this connection

iii) State its area of application.

Marks

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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