Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4857]-1037

S.E. (Electrical) (II Sem.) EXAMINATION, 2015

ELECTRICAL MACHINES—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

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

(*iv*) Use of electronic pocket calculator is allowed.

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

1. (*a*) Sketch and explain Delta-Star connection of 3-ph transformer with its voltage and current relations between primary and secondary. Also give its merits and demerits, and applications. [6]

(*b*) Derive the condition for maximum efficiency of a transformer. Also derive the load current and KVA supplied at maximum efficiency. [6]

Or

2. (*a*) With a neat connection diagram, explain the operation of V-V connection of transformer. [6]

P.T.O.

(*b*) Sketch and explain the phasor diagram of transformer to show primary current I_1 under different condition Lagging loads, Leading loads and Resistive loads. [6]

3. (*a*) With a neat sketch show the different parts of a D.C. machine. Explain any *four* main parts with their functions. [7]

(*b*) A 220 V, dc series motor is running at a speed of 800 r.p.m. and draws 100 A. Calculate at what speed the motor will run when developing half the torque. Total resistance of the armature and field is 0.1 Ω. Assume that the magnetic circuit is unsaturated. [6]

Or

4. (*a*) Sketch and explain the 'Speed *Vs* Armature current' and 'Torque *Vs* Armature current' characteristics of dc shunt motors. Also state its *two* applications. [6]

(*b*) The armature winding of a 4-pole, 250 V, d.c. shunt motor is lap connected. There are 120 slots, each slot containing 8 conductors. The flux per pole is 20 mWb and current taken by the motor is 25 A. Its armature and field winding resistances are 0.1 Ω and 125 Ω respectively. If rotational losses amount to be 810 W. Calculate : [7]

(1) Gross torque

(2) Efficiency.

5. (*a*) Compare sqirrel cage rotor and wound rotor of a 3-ph induction motor. [5]

(*b*) The power input to a 500 V, 50 Hz, 6 poles 3-ph induction motor running at 975 rpm is 40 kW. The stator losses are 1 kW and friction and windage losses total 2 kW.

Calculate : [7]

(*i*) Slip

(*ii*) Rotor copper losses per phase

(*iii*) Shaft power and

(*iv*) Efficiency

Or

6. (*a*) Derive the expression for the torque of a 3-ph induction motor and obtain condition for maximum torque. [6]

(*b*) A 3-ph induction motor having a 4 poles, star-connected stator winding runs on 50 Hz supply with 200 V between the lines. The rotor impedance per phase at standstill is $(0.1 + j\ 0.9)\Omega$. The ratio of rotor to stator turns is 0.67. Calculate : [6]

(*i*) total torque at 4% slip

(*ii*) maximum torque

(*iii*) Speed at maximum torque.

7. (*a*) A 3-ph, 50 Hz, 6-poles induction motor takes 60 A at full load speed of 940 r.p.m. and develops a torque of 150 Nm. The starting current at rated voltage is 300A. What is the starting torque ? If a star/delta starter is used, determine the starting torque and starting current. [6]

(*b*) Draw and explain how to construct the circle diagram of an induction motor indicating the stator Cu loss, rotor Cu loss, fixed loss, full load current, output line torque line and maximum input line on the circle diagram. [7]

Or

8. (*a*) Why starters are necessary for starting 3-ph induction motor ? Describe the operation of autotransformer starter with neat diagram and also give related equations. [7]

(*b*) Draw the explain the exact and approximate equivalent circuit diagram of induction motor along with the required equations. [6]