Ref. No. : Ex/PRN/PE/T/123/2018

B.E. PRINTING ENGINEERING FIRST YEAR SECOND SEMESTER – 2018

Subject: **ELECTRICAL TECHNOLOGY** Time: 3 hrs Full Marks: 100

Instructions: Answer question no. 1 and any four from the rest.

1. Short answer type questions- $2 \times 10 = 20$

(a) Name the material that is used in the transformer core. State the reason for using this particular material.

(b) State the relation between the line and phase current and line and phase voltage for three phase delta and star connection.

(c) What will happen if the rotor speed of an induction motor becomes equal to the synchronous speed?

(d) How can we reverse the rotation of a dc machine?

(e) Why starter is an essential part of a dc motor?

(f) What is the function of commutator in a dc machine?

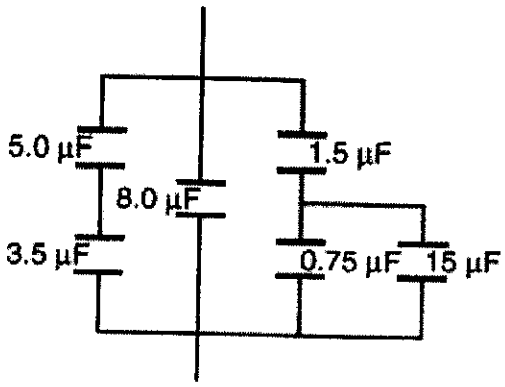
(g) How a capacitor will operate, when a dc energy source is connected across it?

(h) What is the necessary measure required to take, when there is no residual magnetism in the field of a self-excited dc generator?

(i) Define eddy current loss.

(j) State two merits of wound rotor or slip ring rotor.

2. (a) Calculate the equivalent capacitance of the following circuit - 5



(b) Deduce the RMS value of a sinusoidal voltage waveform. 3

(c) The voltage and current in a circuit element is $v = 100 \cos (377 t - 80^\circ)$; $i = 10 \cos (377 t + 10^\circ)$. Identify the element & obtain its value. 7

(d) Define KVL and KCL with suitable explanation. 5

3. (a) State the working principle of a transformer. 5

(b) Deduce the e.m.f. equation of a transformer. 5

(c) A single phase 240/20 V, 50 Hz transformer has the secondary full-load current of 180 A. It has 45 turns on its secondary. Calculate (i) the voltage per turn for both primary and secondary, (ii) the number of primary turns, (iii) the full-load primary current and (iv) the KVA output of the transformer. 10

4. (a) Derive the torque equation of a dc machine. 5

(b) Briefly describe the voltage build-up in self-excited generators. 5

(c) A 440 V, dc compound generator has an armature, series field, and shunt field resistances of 0.5 Ω, 1.0 Ω and 200 Ω respectively. Calculate the generated voltage while delivering 40 A to external circuit for both long-shunt and short-shunt connections. 10

5. (a) Draw and explain the torque/armature current characteristic of a separately excited dc motor. 5

(b) Draw the connection diagrams of dc compound motors along with their corresponding emf equations. 3 + 3

(c) A 120 V dc shunt motor having an armature circuit resistance of 0.2 Ω and field circuit resistance of 60 Ω, draws a line current of 40 A at full load. The brush voltage drop is 3 V and rated full-load speed is 1800 rpm. Calculate (i) the speed at half load, (ii) the speed at 125 percent full load. 9

6. (a) A 3-phase, 6 pole, 50 Hz induction motor has a slip of 1% at no load, and 3% at full load. Determine : (i) synchronous speed, (ii) no-load speed, (iii) full-load speed, (iv) frequency of rotor current at standstill, (v) frequency of rotor current at full load. 10

(b) Draw the torque-slip and torque-speed characteristic of an induction motor. 3 + 3

(c) What are the reasons behind the skewing of a cage rotor? 4

7. Write short notes on the following topics – (any two) 10 x 2 = 20

(a) Measurement of 3-phase power using 2-wattmeter method.

(b) Principle of operation of a 3-phase induction motor.

(c) Draw the basic construction of a dc machine and write down the functions of each part.