B.E. COMPUTER SCIENCE AND ENGINEERING SECOND YEAR FIRST SEMESTER - 2018

SUBJECT: ELECTRICAL TECHNOLOGY

Time : Three hours **Full Marks 100**

No. of questions

Part - I

Answer any *two* (2×20 = 40) questions

Use Separate Answer scripts for each Group.

Marks

1.	(a)	How can the open circuit characteristic of a separately excited generator be determined experimentally? What is the effect of speed on this characteristic?	6
	(b)	A separately excited DC machine with an armature resistance of 0.5Ω, supplies 5kW at 220V, when run as a generator at a speed of 1000rpm. What would be the speed of the machine when run as a motor, if it is fed by the same voltage, draws same current but the flux/pole is increased by 15%?	6
	(c)	Explain how the speed of a shunt motor can be varied above and below the normal speed.	8
2.	(a)	Explain how a three phase alternator can be synchronized to an existing grid. What are the preconditions for safe synchronization?	6
	(b)	Derive and draw the torque-angle characteristics of a synchronous motor. Mark various regions of operation.	7
	(c)	A three phase synchronous generator connected to 22kV grid, has a synchronous reactance of 5Ω per phase. It is delivering 12MW and 5MVAr to the system. Calculate (i) Phase angle of the current with respect to grid voltage (ii) Power and torque angle (iii) generated emf.	7
3.	(a)	Derive the speed-torque characteristics of a DC series motor. Why these motors are popular in traction application?	7
	(b)	Derive and plot the external characteristics of a DC shunt generator.	6
	(c)	Using proper phasor diagrams, show that power factor of synchronous motor for a given power and voltage, can be controlled by controlling the excitation.	7

PART II (60 Marks)

Answer any three questions (20× 3)

1. (a) Distinguish between Electric Circuit and Magnetic circuit. Define eddy current. How we can minimize Hysteresis loss and eddy current loss. Derive the relation between Magnetic flux and Ampere turns. How Hysteresis loop is formed with the alternating current supply. (3+2+4+3+4)
   (b) Determine the hysteresis loss in an iron core weighing 50kg having a density of $7.8 \times 10^{-3} kg/m^3$ when the area of the hysteresis loop is $150cm^2$, frequency is 50Hz and scales on x and y axes are : 1cm=30AT/cm and 1cm=$0.2wb/m^2$. (4)

2. (a) Derive V_{rms}, V_{avg}, Form factor and Peak factor for a Triangular wave form. Draw the Power triangle and write the relation among the sides of powers triangle. (2+2+2+2+2+3)
   (b) 240V, 50Hz single phase supply gives 5A to a series circuit consisting of resistance and a coil. Voltage across the Resistance is 120V and Coil is 200V. Calculate
   (i) R, X_L and Z.
   (ii) Power absorbed by the coil.
   (iii) Power factor of the input current. (3+2+2)

3. (a) Write the Two Wattmeter method to measure the balanced three phase power with suitable circuit diagram and phasor diagram and mention when total power consumed by the two wattmeters is zero. Prove $E_L=\sqrt{3}E_{Ph}$. Where E_L= Line voltage and E_{ph}= Phase Voltage. (8+4+3)
   (b) Three equal star connected inductor takes 8kW at a power factor 0.8 when connected across a 460V, 3-phase, 3-wire supply. Find the circuit constant of the load per phase. (5)

4. (a) Derive the EMF equation of single phase transformer. Why Open Circuit test is performed on Low Voltage side in case of single phase transformer? Draw the Phasor diagram on load in case of single phase transformer. (7+3+5)
   (b) A single phase transformer with a ratio of 440/110V takes a no-load current of 5A at 0.2 power factor lagging. If the secondary supplies a current of 120A at a power factor of 0.8 power lagging. Estimate the current taken by the primary. (5)

5. Write short note any four of the following. (5+5+5+5)
   (a) Short Circuit test of Single Phase transformer.
   (b) Working Principle of 3-phase Induction motor.
   (c) Equivalent Circuit of Single Phase transformer.
   (d) Power Factor calculation in case of Two Wattmeter method.
   (e) Series Resonance in case of RLC circuit.
   (f) Core loss separation process.