B.E. CHEMICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAMINATION (Old), 2019

SUBJECT : ELECTRICAL TECHNOLOGY

Full Marks -100

Time : Three hours

Part-I
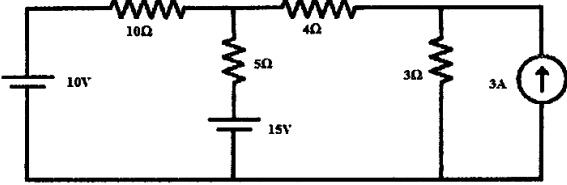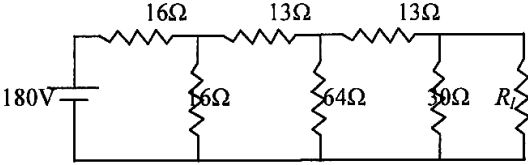**(60 marks)**

Use separate Answer Script for each Part

No. of question	Answer any three questions.	Marks
1. a)	Derive and explain the external characteristic of DC shunt generator.	8
b)	Explain the voltage build-up process in a self-excited DC generator.	7
c)	A 4-pole machine has 60 slots and 8 conductors per slot. The total flux per pole is 20 mWb. For relative speed of 1500 r.p.m. between field flux and armature winding, Calculate the generated armature voltage if the machine is DC machine with wave connected winding.	5
2. a)	Derive the equation of electromagnetic torque generated in a dc motor.	5
b)	Justify: Commutator acts as an inverter in a DC motor.	5
c)	Discuss the torque-armature current characteristics of DC series and shunt motor.	10
3.a)	Derive the e.m.f equation of a single phase transformer.	4
b)	A single phase transformer has 400 primary and 1000 secondary turns. The net cross sectional area of the core is 60 cm^2. If the primary winding be connected to a 500 V, 50 Hz supply. Calculate the peak value of the flux density in the core, and (b) the voltage induced in the secondary winding.	6
c)	Draw and explain the phasor diagram for a single transformer working under a lagging load condition.	10

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Part-1
(60 marks)

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4. a)	Derive and plot the torque speed characteristics of three phase induction motors. Show the stable range of motoring operation.	10
b)	A 3-phase induction motor is wound for 4-poles and is supplied from 50 Hz system. Calculate the (i) Synchronous speed (ii) the rotor speed when slip is 4% and (iii) rotor frequency when rotor runs at 600 rpm.	6
c)	Why an induction motor cannot run at synchronous speed?	4
5.	Write short notes on the following (Any Two) : a) Construction of DC machines b) Speed-torque characteristic of DC series motor c) Rotor construction of squirrel cage induction motor(SQIM) and wound rotor induction motor(WRIM) d) Principle of operation of a three phase induction motor	2x10

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Part-II
(40 marks)

Use separate Answer Script for each Part

No. of question	**Answer any two questions.**	Marks
1. a)	State Superposition theorem. Apply Superposition theorem to find out current through the 4Ω resistance in the given circuit.	8
b)	For the given network, find the value of the load resistance R_L so that maximum power is transferred to the load. Also find the value of maximum power.	8
c)	Define magnetic circuit. Mention its similarities and dissimilarities with any electric circuit.	4
2. a)	A balanced delta-connected load consumes 10 kW at a p.f. of 0.75 (lagging) from a balanced 3-phase, 415V, 50Hz supply. Calculate the resistance and inductance of each phase of the load. If these impedances were connected in star and fed from the same supply, what would be the total power consumption?	8
b)	Draw and label a pure Sinusoidal wave form of current waveform. Deduce the relation of R.M.S. and Average value(s) of it with respect to the maximum value.	8
c)	Briefly describe eddy current loss and hysteresis loss.	4
3.a)	A 230 V, 50 Hz supply has been impressed across a series connection of 10 ohm resistance, inductance of 0.5 Henry and capacitance of 150 micro Farad. Determine (i) Impedance, (ii) Current, (iii) Power consumption of the circuit. Draw the necessary phasor diagram.	6

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Part-II
(40 marks)

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b)	Explain the process of measurement of power and power factor of a three phase system using two wattmeters assuming balanced load and sinusoidal voltage and current.	8
c)	An iron ring has a mean diameter of 20 cm and a cross sectional area of 4 cm^2. It is wound with a coil of 1000 turns. An air gap of 1.5 mm width is cut in the ring. Determine the current required in the coil to produce a flux of 0.50 mWb in the air gap if the relative permeability of iron under this condition is 800. Neglect leakage and fringing.	6
4.	Write short note on (*any two*): (a) Maximum Power Transfer Theorem (b) Hysteresis Loop (c) Star- Delta Transformation of Electrical Network	10x2