Ref. No.EX/ETECH/EE/CSE/T/216A/2016

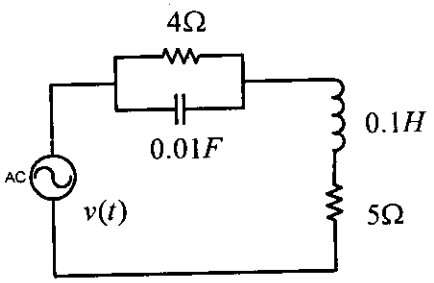
B. CSE 2ND YEAR 1ST SEM. EXAM.-2016

SUBJECT: ELECTRICAL TECHNOLOGY

Full Marks : **100**

Time : **Three hours**

Use a separate Answer-Script for each part

No. of questions		Part - I Answer any ***three*** questions	Marks
1.	a)	Explain the meaning of power factor of an AC circuit.	4
	b)	Explain the phenomena of electrical resonance in AC parallel R-L-C circuits. Evaluate the p.f. at resonant condition, showing related phasor diagram. Why is this called a rejector circuit?	6
	c)	In the circuit shown, current drawn from the source is $i(t) = 3\sqrt{2}\sin(2\pi \times 50 \times t)$. Find (i) $v(t)$ (ii) power drawn from the source. (iii) power factor of the circuit looking from the source (iv) if the inductor is variable what should be its value to achieve series resonance in this circuit? 	10
2.	a)	What is phase sequence of a three phase voltage source?	3
	b)	Show that two wattmeter method of power measurement is applicable for both balanced and unbalanced three phase circuits. Discuss with proper circuit diagram.	7
	(c)	Three identical coils, each having resistance of 5Ω and reactance of 30Ω are connected in delta. This three phase balanced load is connected to a three phase 400V supply. Find the line current. If two wattmeters are used to measure the power drawn by the load find readings of the two wattmeters. Show the circuit diagram.	10
3.	(a)	What is eddy current loss? How can this loss be minimized in an electrical machine?	6
	(b)	Predict on the variation of core loss in an electrical machine with variation of the frequency of operation.	6
	(c)	An iron ring with mean circumferential length of 50cm, cross sectional area 1cm^2, has an air gap of 1mm. A winding of 400 turns is put uniformly over it. Find the inductance value across the two terminals of the winding. Consider relative permeability of iron to be 500. Also, find the flux density in the air gap if current passing through the winding is 2A.	8
4.	(a)	A 50kVA, 2.2kV/220V, 50Hz single phase transformer has following resistance and leakage reactances: HV side R_1=2Ω, X_1=10Ω, on LV side R_2=0.02Ω, X_2=0.1Ω. The transformer is operated at 80% load with load power factor of 0.9 with HV side connected to rated voltage. Find (i) efficiency of the transformer (ii) input current (iii) LV side output voltage. Neglect core loss and magnetizing component of current.	8
	(b)	Compare shell type and core type transformers.	4
	(c)	Derive the primary referred equivalent circuit of a non-ideal single phase transformer. Mention the assumptions made.	8
5.	(a)	Derive and plot the torque speed curve of three phase induction machine. Show the stable range of motoring operation.	6
	(b)	Why the no load current of an induction motor is higher compared to a transformer of equivalent rating?	3
	(c)	Why resistances are added to the rotor of a slip-ring induction motor at starting and removed in steady state of operation?	5
	(d)	How would you determine the equivalent circuit parameters of an induction machine?	6

Part-II

Answer any *two* questions

1. (a) Derive emf and torque equations for d.c. machines. 4

   (b) Discuss how both emf and torque equations are applicable simultaneously for both d.c. motor and d.c. generator. 4

   (c) Describe and compare speed control methods for d.c. shunt motor (i) below base speed, and, (ii) above base speed. 6

   (d) A 200 volt d.c. shunt motor takes 22 Amp at rated voltage and runs at 1000 rpm. Its field resistance is 100 ohm and armature circuit resistance is 0.1ohm. Compute the value of additional resistance required in the armature circuit to reduce the speed to 800 rpm. Assume the load torque to be proportional to the speed. 6

2. (a) Show how d.c. generators can be classified with respective connection diagrams and external characteristics. 8

   (b) Explain how voltage builds up in a d.c. shunt generator. What are the conditions that are to be satisfied to ensure that voltage build-up takes place? 4+4

   (c) A d.c. shunt generator delivers 12 kW at 240 volt while running at 1500 rpm. Calculate the speed of the machine when run as a shunt motor taking 12 kW at 240 volt. The armature resistance is 0.1 ohm and field resistance is 80 ohm. 4

3. (a) Derive from the fundamentals an expression for induced emf in an alternator clearly showing the effects of pitch and distribution factors. 6

   (b) Develop the equivalent circuit for a non-salient pole alternator showing how the synchronous reactance consists of two components of reactance. 4

   (c) Deduce the expressions for real and reactive power for a 3-phase alternator. Draw the power angle characteristics and comment on steady-state stability limit of an alternator. 4

   (d) A 3-phase star connected salient pole alternator has 144 slots with 10 conductors per slot. The alternator is run at 375 rpm. The terminal (line) voltage of the generator is found to be 2.657 kV with a frequency of 50 Hz. Determine the number of poles and the flux per pole. 6