2007-JADAVPUR UNIVERSITY
I B.E I SEMESTER MODEL EXAMINATION
ELECTRICAL TECHNOLOGY-I
(MECHANICAL ENGINEERING)

TIME-3HOUR
MARKS-100

ANSWER ANY FIVE QUESTIONS ALL QUESTIONS CARRY EQUAL MARKS

1 a)
Calculate the currents through the galvanometer by Thevenin's Theorem.

b Turn over Find the loop currents of the circuit shown.

c) What is the condition of maximum power transferred to ZL state and derive it.

2. a) A 100HP 400V 3ph. star connected synchronous motor has resistance and leakage reactance between the lines as 0.08 ohm and 0.8 ohm respectively. Calculate for full load 0.8 P.F. leading the open circuit emf per phase and mechanical power developed when efficiency of motor is 92%.

b) What is the synchronous reactance of a synchronous machine how it can be measured in the laboratory.

c) How the regulation of a synchronous generator depends on the P.F. of the machine - Explain

3. a) A 250V shunt motor has an armature resistance of 0.6 ohm and a field resistance of 250Q. When driving at 650 rpm, a constant torque load, the armature takes 20A. If it is required to raise the speed from 650 rpm to 850 rpm. What resistance must be inserted in the shunt field assuming linear magnetisation characteristic.

b) i) Justify the use of carbon as brushes in D.C. meachine.

ii) What are the reasons for a D.C self excited shunt generater for failure to build up.

iii) Why interpoles are needed for D.C. machine? Draw the connection diagram

iv) Why series motor is used to drive high inertia load?

4. a) Draw neatly and explain the working principle of a spring controlled moving coil ammeter. Can it be used for AC/DC or both ? Reason out.

b) A shunt to be designed for an ammeter in case of variable frequency input. Derive the condition for which division of currents should be independent of frequency.

c) Calculate the resistance of shunt required to make a milliammeter which gives maximum deflection for a current of 15mA. Which has a resistance of 5 ohm read upto 10 amp.

5. a) What is leakage flux and fringing effect in a magnetic circuit ?

b) Prove that unit of reluctance is ampere per weber.

c) A cast steel ring has a circular cross section 3cm in diameter and a mean circumference of 80cm. The ring is wound with a coil of 100 turns

i) Calculate the current required to produce a flux of 0.5 mWb in the ring.

ii) If a saw cut 2mm wide is made in the ring, find the value of current if the usefull flux required in the air gap is 0.5 mWb. Assume 25% of the useful flux as the leakage flux and constant permeability of cast steel equal 1.1×10^{-3} H/m.

6 a) Prove that an ideal inductance does not consume any power over the full cycle of a.c. sinusoidal wave.

b) A voltage v=100 sin 314t is applied to a circuit consisting of a 25 ohm resistor and a 80 microFarad capacitor in series. Find

i) an expression for the value of current flowing at any instant.

ii) the power consumed.

c) A resistor is connected in parallel with a 40 microFarad capacitor to an a.c. supply at 110V, 50C/S. The supply current and voltage are found to differ in phase by 30°. Determine the value of the resistance and supply current. Draw the relevant phasor diagram.

7. a) In a series R-L-C circuit prove that the voltage across the capacitor is Q times the applied voltage under resonance condition, where Q is the quality factor of the circuit.

b) A 10 mH coil is connected in series with a loss-free capacitor to a variable frequency source which supplies a constant voltage of 10V. The circuit current has a maximum value of 0.1 A at a frequency of 80 KHz.

Calculate
i) the capacitaree of the capacitor and

ii) the Q factor of the coil.

c) A star connected load has impedance of (3+j4) ohm in each phase and connected across a balanced three phase delta connected alternator having the line voltage of 120V. Obtain the line currents of both the load and alternator.