

**II B.Tech I Semester Regular Examinations, November 2007**  
**ELECTRICAL ENGINEERING**  
 ( Common to Mechanical Engineering, Chemical Engineering, Mechatronics  
 and Production Engineering)

Time: 3 hours

Max Marks: 80

**Answer any FIVE Questions**  
**All Questions carry equal marks**

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1. (a) State and explain KCL and KVL with suitable examples.  
 (b) Two identical 750 turn coils A and B lie in parallel planes. A current through at the rate of 1500 A/s in A induces an emf of 11.25V in B. Calculate the mutual inductance of the arrangement. If the self inductance of each coil is 15mH, calculate the flux produced in coil A per ampere and the percentage of this flux which links the turns of B. [8+8]
  
2. (a) A series R C circuit is excited by sinusoidal voltage  $I = I_m \sin \omega t$ . Find the expression for impedance using phasor diagram.  
 (b) A voltage  $v(t) = 10 \sin \omega t$  is applied to the series RLC circuit. At the resonant frequency of the circuit, the maximum voltage across the capacitor is found to be 500V. Moreover, the bandwidth is known to be 400rad/sec, and the impedance at resonance is  $100\Omega$ . Find the resonant frequency. Also find the values of L and C of the circuit. [4+12]
  
3. Explain different parts of a d.c generator? [16]
  
4. (a) Explain the working of a 3-point starter with a circuit. Diagram for a D.C.Shunt motor  
 (b) A dc shunt machine develops an O,C emf of 250V at 1500rpm. Find its Torque and its mechanical power developed for armature current of 50A. State the simplifying assumption. [8+8]
  
5. (a) What are the disadvantages of swinburns test  
 (b) Obtain Equivalent circuit of a 200/400V, 50 Hz 1- $\Phi$  transformer from the data:
 

o.c test	200V	0.7A	70W	L.V.side
s.c test	15V	10A	85W	H.V.side

 Also calculate the secondary voltage when delivering 5KW at 0.8 lag ,  $v_1=200V$ . [6+10]
  
6. (a) Derive the condition for maximum torque at starting of a 3-phase induction motor  
 (b) A 4-pole,50Hz induction motor has a full-load slip of 5% .Each rotor has a and reactance of  $0.3\Omega$ /phase and  $1.2\Omega$ /phase.respectively at standstill. Find the ratio of maximum torque to full-load torque and the speed at maximum torque. [6+10]

7. (a) Discuss the construction, and principle of operation of a 3-phase Synchronous Generator.
- (b) A 3-phase, 4-pole, 50-Hz , star-connected alternator has 60 slots with 2 conductors per slot and having armature winding of the double layer type. Coils are short-pitched, that is, if one coil side lies in slot number I, the other coil side lies in slot number 13. find the useful flux per pole required to induce a line voltage of 6.6 kv. [8+8]
8. (a) Explain the steps involved in the extension range of voltmeters
- (b) Explain the Fluid-Friction Damping in an indicating instruments with neat sketch. [8+8]

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1. Find the equivalent resistance  $R_{eq}$  of the network (figure1) at the terminals 'a' & 'b' using transformations  $Y-\Delta$  &  $\Delta-Y$ . [16]

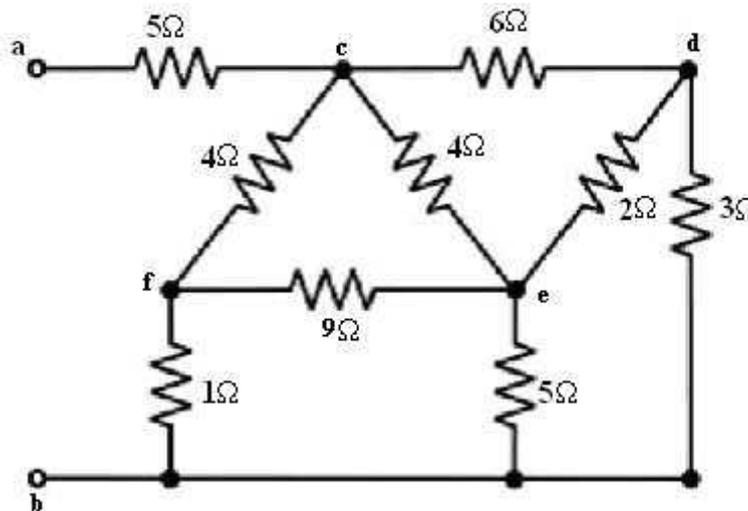


Figure 1

2. (a) Define RMS value and average value of an alternating quantity.  
 (b) For the circuit shown, determine the total impedance, total current and phase angle (figure2b). [4+12]

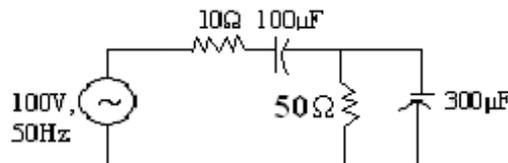


Figure 2b

3. (a) Derive the condition for maximum efficiency of a D.C. generator?  
 (b) The shunt generator delivers full load current of 200A at 240V. The shunt field resistance is  $60\Omega$  and full load efficiency is 90%. The starting losses are 800w. find
- i. armature resistance
  - ii. current at which maximum efficiency occurs?
  - iii. Total losses
  - iv. armature copper losses?
- [16]

4. (a) What is the condition for maximum power in a D.C.MOTOR  
 (b) A 200V D.C shunt machine had a line current of 40A It armature and field resistance of 0.22 and 200 $\Omega$  respectively calculate power developed in armature when running  
 i. Motor  
 ii. Generator  
 iii. Copper losses. [6+10]
5. (a) What are the disadvantages of swinburns test  
 (b) Obtain Equivalent circuit of a 200/400V, 50 Hz 1- $\Phi$  transformer from the data:
- |          |      |      |     |          |
|----------|------|------|-----|----------|
| o.c test | 200V | 0.7A | 70W | L.V.side |
| s.c test | 15V  | 10A  | 85W | H.V.side |
- Also calculate the secondary voltage when delivering 5KW at 0.8 lag ,  $v_1=200V$ . [6+10]
6. (a) Derive the expression for starting torque of a 3- $\Phi$  transformer  
 (b) A 150KW, 3000V, 6-pole,50Hz star connected Induction motor has star connected slip ring rotor with a transformation ratio of 3.6. the rotor resistance is 0.1 $\Omega$ /phase and leakage reactance per phase is 3.61mH the stator impedance may be neglected. Find the starting current and starting Torque on rated voltage with short circuited slip rings. [8+8]
7. (a) Can D.C. Generator be converted into an Alternator? Explain  
 (b) Why Alternators are rated in KVA rather than in KW  
 (c) What is meant by Full-pitched and Short-pitched windings. [5+5+6]
8. Explain the following with relevant diagram  
 (a) Deflecting Torque  
 (b) Controlling Torque  
 (c) Damping Torque. [16]

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1. (a) Define coefficient of coupling, magneto motive force, and reluctance.  
 (b) Find the power loss in  $1\Omega$  resistor shown in the figure1b. [6+10]

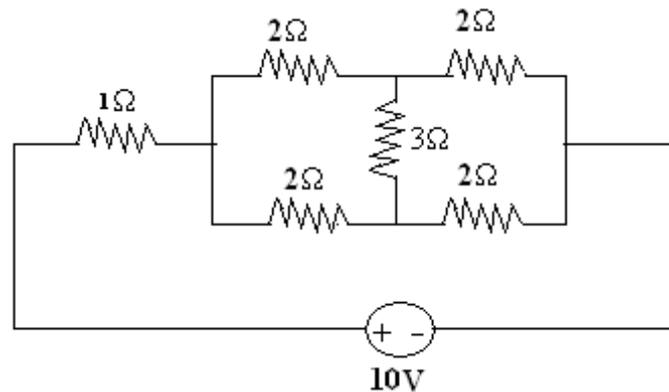


Figure 1b

2. (a) Explain how a sinusoidal quantity can be represented by a phasor  
 (b) In the circuit shown, the current is at its maximum value, when the capacitor value is  $20\mu\text{F}$  and 0.707 times its maximum value with  $C = 30\mu\text{F}$ . Find the quality factor  $Q$  at  $\omega = 500\text{rad/sec}$ , and the circuit constants (figure2b). [8+8]

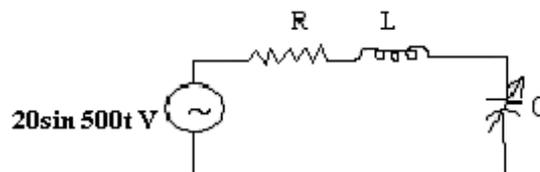


Figure 2b

3. Explain different parts of a d.c generator? [16]
4. (a) Explain the various methods of speed control of a D.C.shunt motor  
 (b) A 460V D.C series motor run at 1000rpm, taking a current of 40A. Calculate the speed and percentage change torque if the load is reduced so that the motor taking 30A. Total resistance of the armature and field circuits is  $0.8\Omega$ . (Assume flux is proportional to field current). [8+8]
5. (a) Explain how the equivalent circuit parameters can be obtained from o.c and s.c tests.

- (b) A 100 KVA, 1000v/10000v, 50Hz, 1- $\Phi$  transformer has an iron loss of 1200W. Find the maximum efficiency at 0.8 p.f lagging if the copper loss is 500W with 6A in H.V side also calculate the corresponding regulation if the equivalent leakage reactance referred to HV side is  $10\Omega$ . [8+8]
6. (a) How do you classify the induction motors. Give the constructional details of them.
- (b) A 3- $\Phi$  Induction motor with  $\frac{R_2}{X_2} = 0.5$  has a starting torque of 25N-m for negligible stator impedance and no load current, determine the starting torque when the rotor circuit resistance per phase is
- i. doubled
  - ii. halved. [6+10]
7. (a) Compare salient pole and non salient pole type Synchronous machines
- (b) The stator of a 3-phase, 16-pole Alternator has 144 slots and there are 4 conductors per slot connected in two layers and the conductors of each phase are connected in series. If the speed of the Alternator is 375 rpm, calculate the emf induced per phase. Resultant flux in the air-gap is 0.05 webers per pole sinusoidally distributed. Assume the coil span as 150 degrees electrical. [6+10]
8. A Moving coil ammeter has a fixed shunt of  $0.02\Omega$  with a coil resistance of  $R = 1000\Omega$  and a potential difference of 500mv across its full scale deflection is obtained.
- (a) To what shunted current does this correspond?
  - (b) Calculate the value R to give full scale deflection when shunted current I is
    - i. 10 A
    - ii. 75A
  - (c) With what value of R is 40% deflection obtained with  $I = 100A$ . [16]

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1. (a) Find the voltage across the  $2\Omega$  resistor shown in the figure1(b)ii.
- (b) Two coils, A of 12,500 turns and B of 16,000 turns lie in parallel planes so that 60% of flux produced in A links coil B. It is found that a current of 5A in A produces a flux of 0.6mWb while the same current in B produces 0.8mWb. Determine
  - i. mutual inductance and
  - ii. coupling coefficient. [8+8]

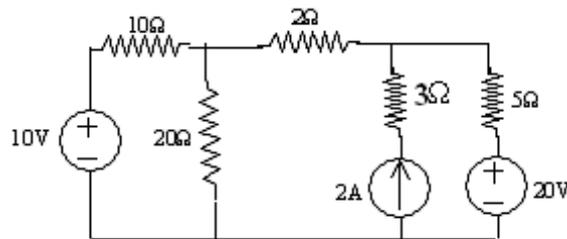


Figure 1(b)ii

2. (a) For a series resonance circuit obtain the expression for bandwidth in terms of resonance frequency and band width.
- (b) A balanced 3-phase, delta connected load of  $(2+j3)\ \Omega$ /phase is connected to a balanced 3-phase 440V supply. The phase current is 10A. Find total active power, reactive power and total apparent power in the circuit. [8+8]
3. (a) What is the principle of operation of a d.c. generator, explain with help of a diagram?
- (b) A 4-pole generator having wave wend armature winding has 51 slots each slot contains 20 conductors. What will be the voltages generated in the machine when driven at 1.500 r.p.m assuming the flux per to be 7.0m wb? [16]
4. (a) Explain how the torque of a D.C. Shunt and D.C. series motor varies with the speed of the motor
- (b) The speed of a 50 H.p series motor working on 500V supply is 750 rpm at full load and 90% efficiency. If the load torque is made 350 N-m and a  $5\Omega$  resistance is connected in series with machine, calculate the speed at which the machine will run. Assume the magnetic circuit to be unsaturated and the armature and field resistance to be  $0.5\Omega$ . [8+8]

5. (a) Explain the o.c and s.c tests on the transformer and hence explain the evaluation of equivalent circuit from it
- (b) A 40 KVA transformer with a ratio of 2000/250V has a primary resistance of  $1.15\Omega$  secondary resistance of  $0.0155\Omega$ . Calculate
- i. the total resistance in terms of secondary windings,
  - ii. the total resistance on full load and
  - iii. the total copper loss on full load. [8+8]
6. (a) Explain the construction of 3- $\Phi$ , induction motor with neat sketch.
- (b) A 3- $\Phi$  induction motor at standstill has a rotor voltage of 100V between the slip rings. The rotor winding is star connected and has a leakage reactance of  $1\Omega$ /phase at standstill and a resistance of  $0.2\Omega$ /phase. Calculate
- i. the rotor current when the slip is 4% and
  - ii. the slip and rotor current when the motor develops maximum torque. (assume flux remains constant). [6+10]
7. (a) Sketch and explain the open-circuit and short-circuit characteristics of a Synchronous machine
- (b) A 50 Hz, 3-phase, star-connected alternator which generates 10,000 V between lines on open-circuit, has a flux per pole of  $15 \times 10^{-2}$  wb. If the distribution factor of the full-pitch coil is 0.96, find the number of armature conductors in series per phase. [8+8]
8. (a) Explain the Different types of Controlling Torques in an indicating instruments
- (b) A moving coil voltmeter with a resistance of  $100\Omega$  gives a full scale deflection of  $100^\circ$ . When a potential difference of 110 mv applied across it. The moving coil has dimensions of 20mm x 15mm and is wound with 1000 turns, spring constant is  $0.2 \times 10^{-6}$  N-m /deg. Find the flux density in the air gap. [8+8]

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