Set No. 1

II B.Tech I Semester Regular Examinations, November 2006
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 Kirchhoff's Laws with suitable examples.

   (b) Determine the equivalent resistance between the terminals A and B of the network shown in the figure1. [4+12]
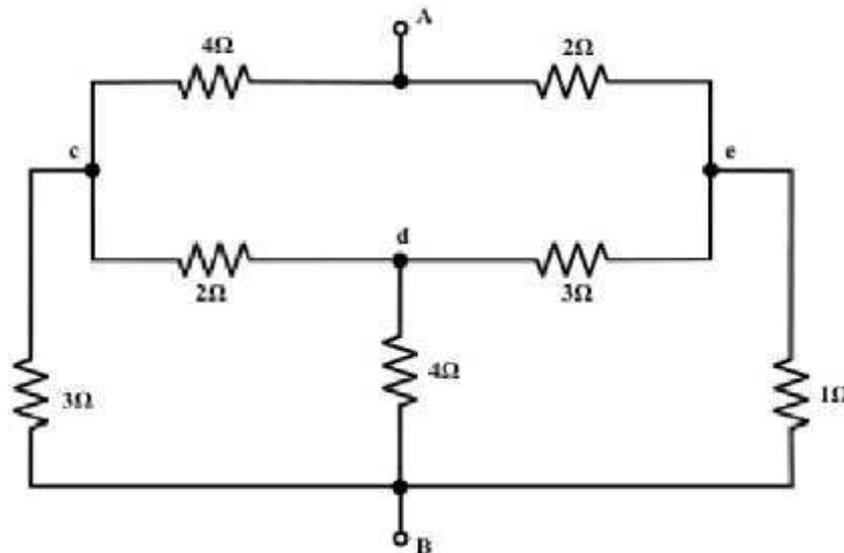

Figure 1

2. (a) Derive the expression for resonance frequency of a series RLC circuit

   (b) A parallel circuit consists of two branches Z_1 and Z_2 and is connected to supply of 100V rms, 50Hz. In branch Z_1, there is a resistance of 10Ω in series with an inductor with an impedance of $j20\Omega$, while Z_2 consists of a resistance of 8Ω in series with a capacitor with an impedance of $-j15\Omega$. Find the total current drawn from the supply. What is the power factor of the combination? [8+8]

3. In a dc-machine the total iron loss is 8kw at its rated speed if the excitation remains the same, but speed is reduced by 25% , the total iron loss is found to be 5kw. Calculate the hysterisis and eddy current losses at

   (a) full speed

   (b) half the rated speed. [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 0.8Ω.(Assume flux is proportional to field current). [8+8]

5. (a) Discuss the constructional features of transformers.Draw neat diagrams

   (b) Calculate the flux in the core of a1−Φ transformer having a primary voltage of 50 Hz and 50 turns. If the flux density in the core is 1 Tesla. Calculate the net Cross-sectional area of the core. [8+8]

6. (a) Explain the operation of slip ring induction motor.

   (b) A 3-Φ, 4-pole,1440rpm,50Hz Induction motor has star connected rotor winding, having a resistance of 0.2Ω/phase and stunel still lekage of 1 Ω/phase . when the stator is energized at rated voltage and frequency, the rotor induced emf at stand still is 120V/phase.

      i. calculate the rotor current , rotor power factor and torque both at starting and at full load and compare the results.

      ii. If the external resistance of 1Ω/phase is inserted in rotor circuit, calculate rotor current rotor power factor and torque at the time of starting.[6+10]

7. (a) Explain OC and SC tests of an alternator. how regulation can be calculated by the use of their results?

   (b) A 60-kVA, 220 V, 50-H$_z$, I-Φ alternator has effective armature resistance of 0.016 ohm and an armature leakage reactance of 0.07 ohm. Compute the voltage induced in the armature when the alternator is delivering rated current at a load power factor of

      i. unity

      ii. 0.7 lagging and

      iii. 0.7 leading. [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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Set No. 2

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. Find the equivalent resistance Req of the network (figure1) at the terminals 'a' &
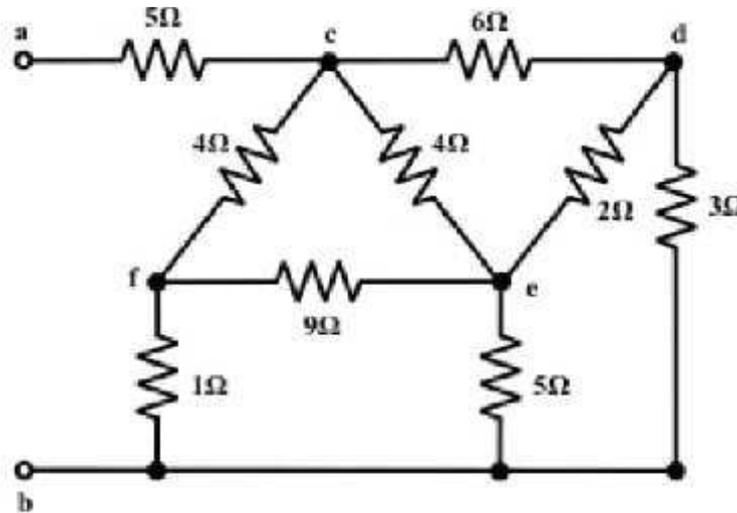   'b' using transformations Y−Δ&Δ−Y. [16]

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 ad phase
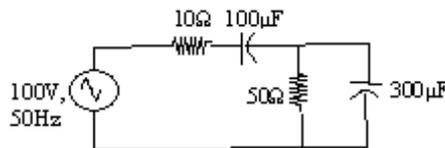   angle (figure2). [4+12]

Figure 2

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 60Ω 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 200Ω respectively colwlate power developed in armature when running

      i. Motor
      ii. Generator
      iii. Copper loses. [6+10]

5. (a) Draw the phasor diagram of a transformer on (i) no-load (ii) full-load with inductive load and explain

   (b) A Single phase transformer has 500 turns in the primary and 1200 turns in the secondary .The cross-sectional area of the core is 80 sq.cm. If the primary winding is connected to a 50 hz supply at 500V. Calculate

      i. peak flux density
      ii. voltage induced in the secondary. [8+8]

6. (a) Explain the constuction of 3-Ω, induction motor with neat sketch.

   (b) A 3-Φ 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 1Ω/phase at standstill and a resistance of 0.2Ω/phase. calculate

      i. the rotor current when the slip is 4% and
      ii. the slip and rotor current when the rotr develops maximum torque. (assume flux remains constant). [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 inducted 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) Explain the different types of Torques for an Indicating instruments

   (b) The coil of a moving coil meter has resistance of 5 and given full scale deflection when a current of 15 mA passes through it .What modification must be made to the instrument to convert it into

      i. an ammeter reading to 15 A
      ii. a voltmeter reading to 15 V. [8+8]

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$$\boxed{\textbf{Set No. 3}}$$

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Time: 3 hours   Max Marks: 80

Answer any FIVE Questions
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1. (a) Derive the Faraday's law of electromagnetic induction from the first principle.

   (b) A 100 turn coil is wound on a magnetic bobbin, the average diameter of the coil can be taken to be 10mm. Find the emf induced in the coil when the flux density B is changed from 5mWb/m2 to 0.1 Wb/m^2 in 35n Sec.

   (c) Four 60W, 110V bulbs are to be operated from a 230V source. Determine the value of the resistance connected in series with the line so that the voltage across the bulbs does not exceed 110V. [4+6+6]

2. (a) A series R C circuit is excited by sinusoidal voltageI $= I_m$ sin wt. Find the expression for impedance using phasor diagram.

   (b) A voltage $\nu(t) = 10 \sin \omega t$ 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 100Ω. Find the resonant frequency. Also find the values of L and C of the circuit. [4+12]

3. In a dc-machine the total iron loss is 8kw at its rated speed if the excitation remains the same, but speed is reduced by 25% , the total iron loss is found to be 5kw. Calculate the hysterisis and eddy current losses at

   (a) full speed

   (b) half the rated speed. [16]

4. (a) Eplain the torque speed characteristics of
       i. D.C. series motor
       ii. D.C shunt motor

   (b) A 220V D.C series motor runs at 500 rpm. When the armature current is 50A. Calculate the speed if the torque is doubled.Given $R_a = 0.2Ω$. [8+8]

5. (a) Define the regulation.Obtain the condition for zero regulation of transformer

   (b) A 3LVA, 1-Φ transformer rated at 50Hz 110/440V give the following data.

S.C Test	9V	6A	21.6W	H.V side
O.C Test	200V	0.7A	60W	L.V side

   For the above Transformer, Draw the eqvivalent circuit. [8+8]

6. (a) Explain the principle of working a three phase induction motor.

(b) A 3-Φ, 600V, 12-pole,50Hz star connected Induction motor has rotor resistance stand still reactance of 0.03 and 0.5Ω per phase respectively.Calculate

    i. speed of full load torque to maximum torque

    ii. ratio of full load torque to maximum torque if full-load speed is 495 rpm.

             [8+8]

7. (a) explain the principle of operation of an Alternator

  (b) Why the Alternator is also named as Synchronous Generator

  (c) The effective resistance of a 2200 V, 50 H_z , 440kVA 1-phase alternator is 0.5 Ω, on short circuit a field current of 40 A gives the full load current of 200 A. The emf on open-circuit with the same excitation is 1,160 V. Calculate the synchronous impendence and reactance.   [5+5+6]

8. (a) Explain the Advantages & Disadvantages of MI Instruments

  (b) The deflecting torque of an ammeter varies as the square of the current passing through it . If a current of 5A produces a deflection of 90^0 .Find the value of current required for a deflection of 30^0 . if the instrument is

    i. Spring control

    ii. Gravity control.   8+8]

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$$\boxed{\textbf{Set No. } \textbf{4}}$$

II B.Tech I Semester Regular Examinations, November 2006
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and Explain Faraday's laws of electromagnetic induction. Distinguish between self inductance and mutual induced voltage.

   (b) Determine the resistance across the terminals ab of the interconnected resistors shown in the figure1.   [8+8]
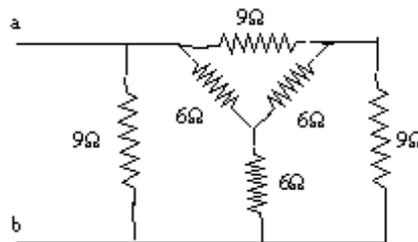

Figure 1

2. (a) Show that the total power consumed in a 3-phase system is same whether the load is star or delta connected.

   (b) In the circuit shown, determine circuit constants when the circuit draws a maximum current at 10μF with a voltage of 10V, 100Hz supply. When the capacitance is changed to 12μF, the current that flows through the circuit becomes 0.707 times its maximum value. Determine the quality factor Q of the coil at 900rad/sec. also find the maximum current that flows through the circuit (figure2).   [8+8]
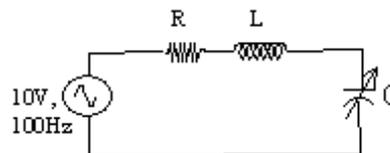

Figure 2

3. (a) Determine the condition for maximum efficiency of a D.C generator?

   (b) A d. c. generator generates on e.m.f. of 520V if has 2,000 armature conductors, flux per pole of 0.013 wb, speed of 1200 r.p.m and the armature winding has four parallel pathe. Fine the number of poles.

   (c) Calculate the flux in a 4-pole dynemi with 722 armature conductors generating 500V when running at 1000 r.p.m. When the armature is

   i. lap connected
   ii. wave connected.   [16]

Set No. 4

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) 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 1.15Ω secondary resistance of 0.0155Ω.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) sketch torque-speed characteristicks of an induction motor at rated voltage and frequency.

(b) calculate the torque exerted by the 8-pole,50Hz Induction motor operating with a 4% slip which develops a maximum torque of 150Kg-m at aspeed of 660 rpm. The resistance per phase of the rotor is 0.5Ω. [8+8]

7. (a) Define the terms Synchronous Reactance and Voltage Regulation of an Alternator. Explain Synchronous Impedance Method of determining Regulation of an Alternator

(b) Draw the vector diagrams of a loaded Alternator. [10+6]

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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