Code No: R05210302 **Set No. 1**

II B.Tech I Semester Supplimentary Examinations, November 2008
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) A transformer has primary winding 1250 turns and the secondary has 740 turns. The length of magnetic path can be taken as 27.5 cm and the cross sectional area of the core is 5.5cm^2. Assuming μ_r =750, find the self inductance of primary and secondary windings separately and the mutual inductance between them.

   (b) For the circuit shown in the figure 1b calculate the potential of points A, B, C and E with respect to point D. Find also the value of voltage source V_1. [8+8]

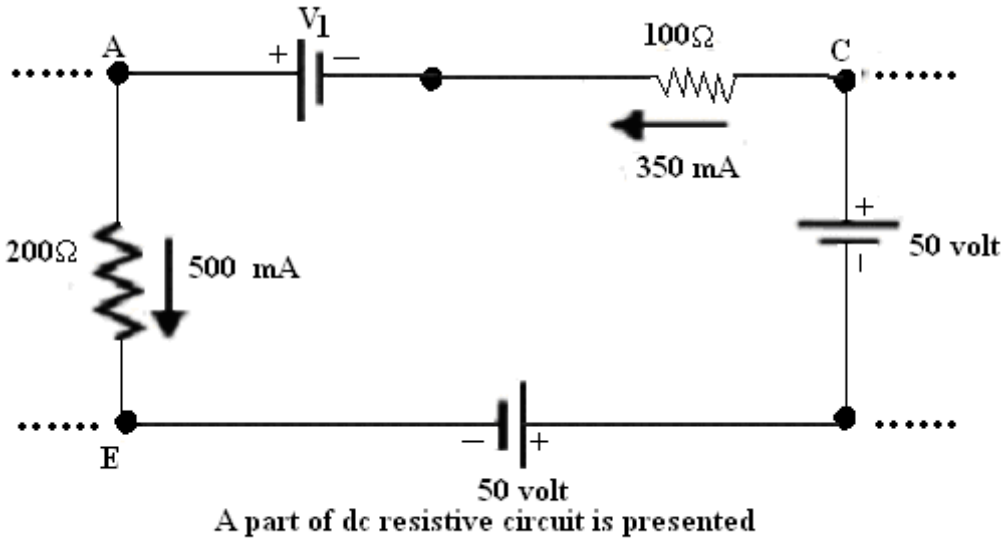

Figure 1b

2. (a) Show that for a series resonant circuit $f_1 f_2 = f_r^2$, where f_1 and f_2 are half power frequencies and f_r is the resonance frequency.

   (b) Determine the voltage across each element of the circuit shown in figure 2b and draw the voltage phasor diagram. [6+10]

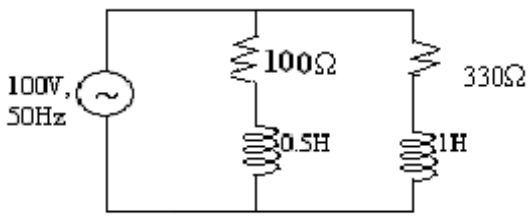

Figure 2b

3. (a) A d.c. shunt generator has full load output of 10kw at a terminal voltage of 240V. The armature and shunt field winding resistance are 0.6 and 160 ohms respectively. The sum of mechanical and core-loss is 500w. Calculate the power required in kw at at the driving shaft at full load the corresponding efficiency?
   (b) The armature of a four-pole dc shunt generator is lap wound and generator 216V when running at 600 r.p.m. Armature has 144 slots,with 6 conductors per slot. If this armature is reward, wave- connected, find the e.m.f generated with the same flux per pole bus running at 500 r.p.m? [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) 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) Derive the expression for starting torque of a 3-Φ 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 0.1Ω/phase and leakage reactance per phase is 3.61mH the stator impedence 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. A voltmeter is connected across a circuit consisting of a millimeter in series with an unknown resistor R . If the readings on the instruments are 0.8V and 12 mA respectively and if the resistance of the millimeter is 6Ω , calculate
   (a) the true resistance of R and
   (b) the percentage error had the resistance of the millimeter been neglected. [16]

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Code No: R05210302 **Set No. 2**

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

Answer any FIVE Questions
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1. (a) Explain:
   i. Statically induced emf and
   ii. Dynamically induced emf
   (b) Find the power absorbed by the 5Ω resistor in the circuit (figure 1b) shown. [8+8]

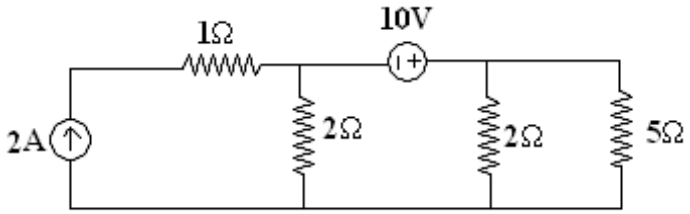

Figure 1b

2. (a) Derive the expression for i(t) for R L series circuit when excited by a sinusoidal source.
   (b) Find the average and RMS values of the half-wave rectified sine wave shown in the figure2b. [8+8]

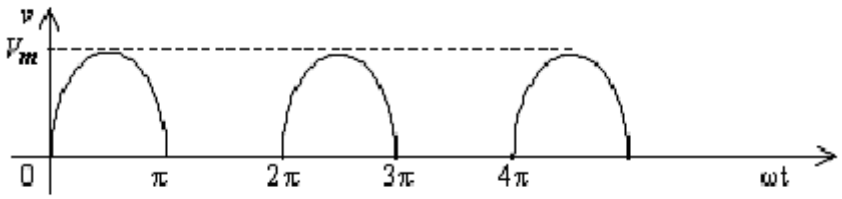

Figure 2b

3. (a) Derive the e .m .f equation of a dc . Generator for both wave - wand and lepwand generators?
   (b) An 6 pole generator armature with 300 conductors is running a speed of 1500 r.p.m find the e .m .f generated when flux per pole is 0.06wb? In both lepwand & wave wand? [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) Discuss the constructional features of transformers. Draw neat diagrams
   (b) Calculate the flux in the core of a1$-\Phi$ transformer having a primary voltage 230V 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 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 at 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) 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. A voltmeter is connected across a circuit consisting of a millimeter in series with an unknown resistor R . If the readings on the instruments are 0.8V and 12 mA respectively and if the resistance of the millimeter is 6Ω , calculate
   (a) the true resistance of R and
   (b) the percentage error had the resistance of the millimeter been neglected. [16]

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Code No: R05210302 **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 relation ship between the self inductances L_1 and L_2 the mutual inductances M of two coupled coils.
   (b) For the network shown (figure1b), calculate the voltage across the terminals ac if a 36V battery is connected across the terminals ab. Also calculate the power dissipated in the 9Ω resistor connected across ab. [6+10]

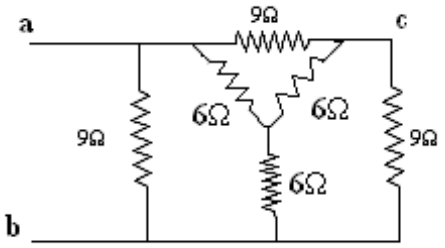

Figure 1b

2. (a) A resistor having a resistance of 10Ω and an unknown capacitor are in series. The voltage across the resistor is $\nu_R(t) = 50\sin(1000t + 45^0)$V. If the current leads the applied voltage by 60^0 what is the unknown capacitance?
   (b) A balanced 3-phase, star connected load of (8+j6) Ω/phase is connected to a 3-phase 230V supply. Find the line current, power factor, real power, reactive volt-amps and total volt-amps. [6+10]

3. (a) Explain the characteristics of D.C generators?
   (b) A separately excited d.c generator has no-load voltage of 120V at a field correct of 2A, when driven at 1,500 r.p.m. Assuming that it is operating on the straight line proportion of its saturation curve, Calculate
      i. the generated voltage when the field current is increased to 2.5A end
      ii. the generated voltage when the speed is reduced to 1,400 r.p.m. and the field current is increased to 2.84A? [16]

4. (a) What are the various losses in a D.C.Machine and explain
   (b) A 250V,4-pole wave wound D.C series motor has 782 conductors on its armature. It hasarmature and field resistance of 0.75Ω. The motor takes a current of 40A. Determine the speed and torque developed if it has a flux per pole is 25mwb. [8+8]

5. (a) Discuss the constructional features of transformers. Draw neat diagrams
   (b) Calculate the flux in the core of a1$-\Phi$ transformer having a primary voltage 230V 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 stand 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) Derive from first principles ,the emf equation of a 3-phase Synchronous Machine
   (b) Calculate the speed and open-circuit line and phase voltages of a 4-pole, 3-phase, 50 H_z star- connected alternator with 36 slots and 30 conductors per slot. The flux per pole is 0.05 Wb sinusoidally distributed. [8+8]

8. Voltage of 80.0Vis applied to a circuit comprising two resistors of resistance 105 ohms and 55ohms respectively. The voltage across the 55 ohm resistor is to be measured by a voltmeter of internal resistance 100 ohm / V. Given that the meter is set to a scale of 0-50V.Determine the voltage indicated. [16]

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1. (a) Explain:
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   ii. Dynamically induced emf
   (b) Find the power absorbed by the 5Ω resistor in the circuit (figure 1b) shown. [8+8]

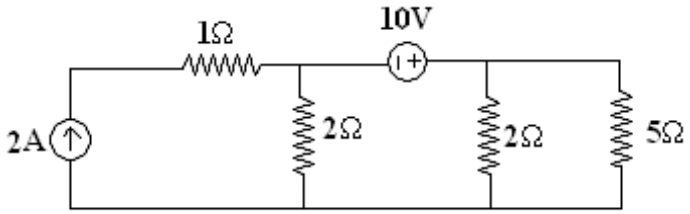

Figure 1b

2. (a) Obtain the expression for frequency at which the voltage across the inductance becomes a maximum in a series RLC circuit. Explain what is meant by voltage magnification factor.
   (b) A two branch parallel circuit with one branch of resistance 100Ω and a single unknown element in the other branch has the following applied voltage and total current. $\nu(t) = 2000\cos(1000t+45^0)$ V; $i_T(t) = 45\sin(1000t+135^0)$A. Find the unknown element. [8+8]

3. In a 120V compound generator, the resistance of armature shunt and series winding are 0.06Ω , 25Ω & 0.04Ω respectively. The load current is 100A at 120V find the induced emf and the armature current when the machine is connected as
   (a) long shunt &
   (b) short shunt. How will the ampere turns of the series field be changed in
   (c) if divertes of 0.1 be connected in parallel with the series field winding? Neglect brush contact drop and ignore armature reaction? [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$-\Phi$ transformer having a primary voltage 230V 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]

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      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]

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   (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. (a) Sketch and described the construction of a Mc Ammeter and give the principle of operation
   (b) A DC voltmeter has a resistance of 28600 . When connected in series with an external resistor across a 480 V DC supply, the instrument needs 220V .What is the value of the External resistance? [8+8]

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