

CODE NO: A109211402

R09

SET - 1

**II B.TECH - I SEMESTER EXAMINATIONS – MAY, 2011**  
**ELECTRICAL ENGINEERING**  
**(MECHANICAL ENGINEERING)**  
**(MECHATRONICS)**

Time: 3hours

Max. Marks: 75

Answer any FIVE questions  
 All Questions Carry Equal Marks

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- 1.a) Find the voltages  $V_1$  and  $V_2$  in the below circuit (shown in Figure 1).

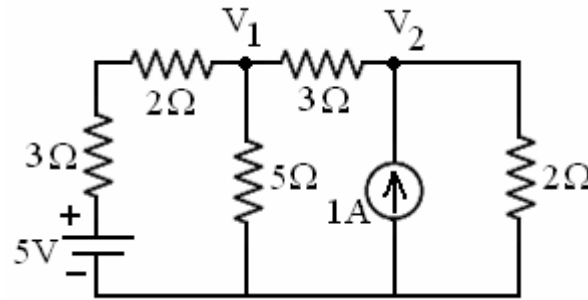


Figure 1

- b) A current wave form shown below in Figure 2 is applied to a capacitor of  $2\mu\text{F}$ . Find the voltage wave form. [7+8]

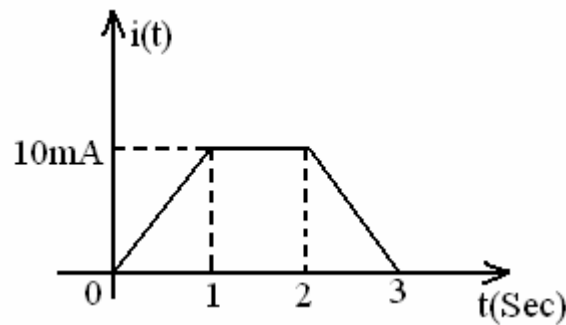


Figure 2

- 2.a) Find  $R_{eq}$  in the below circuit (shown in Figure 3).

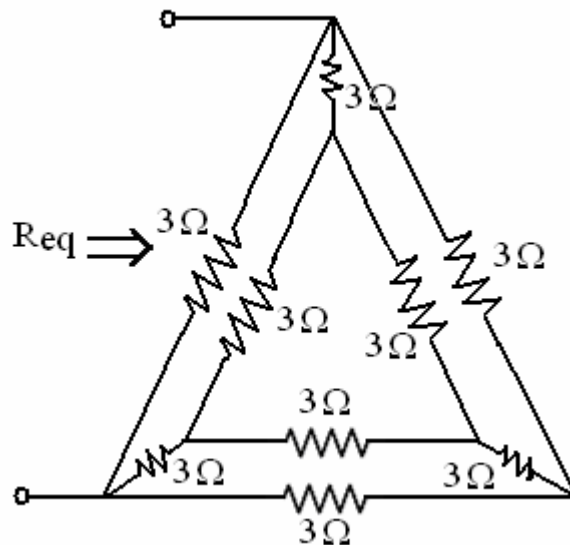


Figure 3

- b) Find the thevenin's equivalent for the below network (shown in Figure 4). [7+8]

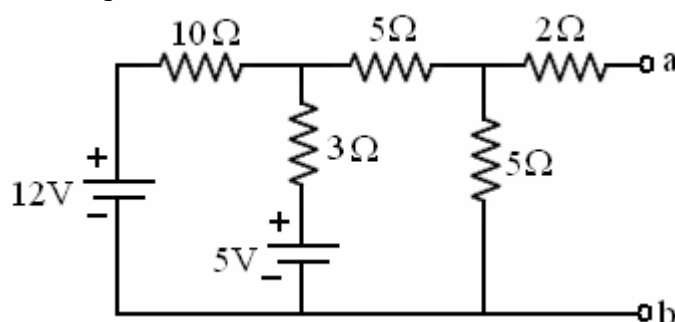


Figure 4

- 3.a) Find the effective value of the triangular wave form shown below in Figure 5.

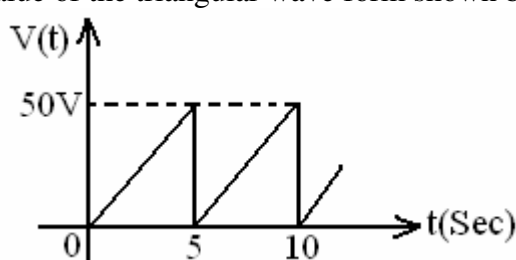


Figure 5

- b) The voltage and current of a circuit are  $V = 200 \sin(\omega t + 60^\circ)$  and  $i = 50 \sin(\omega t + 30^\circ)$ . Calculate average, reactive and apparent power. [7+8]
- 4.a) Derive the EMF equation of a single phase transformer.  
 b) The OC and SC test results of a single phase transformer are shown below.  
 OC Test:  $V_2 = 220V$ ,  $I_0 = 14A$ ;  $W_0 = 330W$  on lv side  
 SC Test:  $V_{SC} = 21.5V$ ,  $I_1 = 45A$ ;  $W_{SC} = 450W$ .  
 Calculate the various parameters of the transformer. [7+8]
5. A 4-pole compound generator supplies a load current of 100A at a terminal voltage of 400V. The armature, Series field and shunt field resistances are  $0.01\Omega$ ,  $0.05\Omega$  and  $200\Omega$  respectively. Calculate the generated emf of the machine. [15]
6. A 6-pole dc motor has a lap connected armature with 90 slots, each slot containing 5 conductors. The flux per pole is 10mwb. The armature resistance is  $0.2\Omega$ . Calculate the speed when the motor is connected to a 240V supply and taking an armature current of 60A. Also calculate the torque developed by the armature. [15]
- 7.a) Draw the Torque – slip characteristics of three phase induction motor.  
 b) A 8-pole, 3Ø Induction motor operates from a supply frequency of 50 Hz. Calculate  
 i) Synchronous Speed      ii) Speed of the rotor for a slip of 0.02.  
 iii) The frequency of the rotor current when slip is 0.03.  
 iv) Frequency of the rotor current when rotor is at stand-still. [7+8]
8. Explain in detail the construction and operation of moving Iron ammeters. [15]

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- 1.a) An inductor of inductance 2H is supplied with a current wave form shown below in Figure 1. Draw the waveforms for voltage and energy in the inductor.

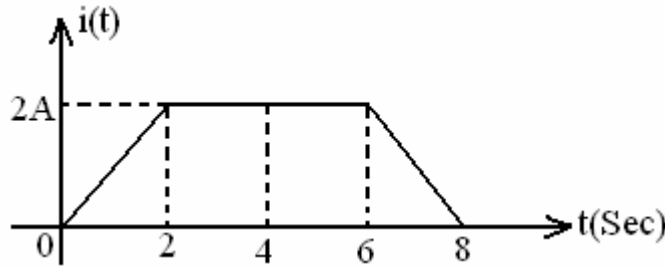


Figure 1

- b) Find the node voltages in the below circuit (shown in Figure 2). [8+7]

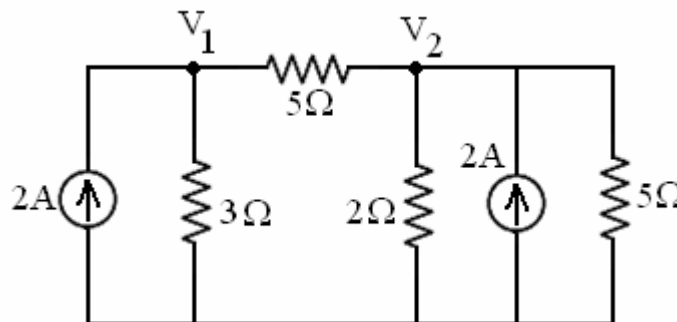


Figure 2

- 2.a) State and explain Norton's theorem.  
 b) What load resistance must be connected across the terminals  $l-l'$  of the below circuit (shown in Figure 3) to get maximum power. [7+8]

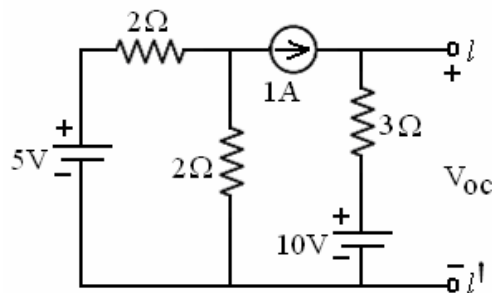


Figure 3

- 3.a) Calculate the form factor of the waveform shown below in Figure 4.

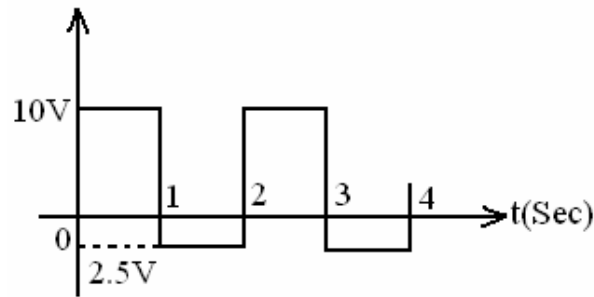


Figure 4

- b) Find the total impedance, total current and phase angle for the below circuit (shown in Figure 5). [7+8]

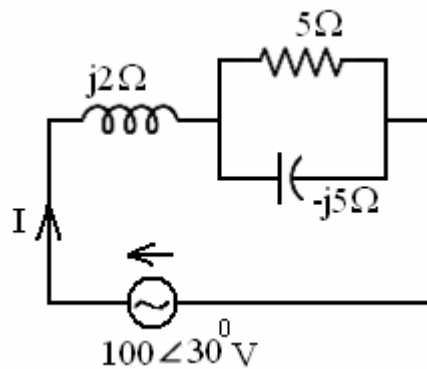


Figure 5

4. A 5KVA, 220/400V, 50Hz, single phase transformer gave the following results.  
 OC Test: 220V, 2A, 150W (lv side)  
 SC Test: 35V, 12A, 270W (lv side)  
 Determine the efficiency and regulations at full load, 0.9p.f. lagging. [15]
5. Explain in detail the principle of operation and constructional details of a DC generator. [15]
- 6.a) Derive the torque expression of a DC motor.  
 b) A dc shunt motor runs at 750 rpm from a 250V supply and takes a full-load line current of 60A.  $R_a = 0.2\Omega$  and  $R_f = 125\Omega$ . Assuming a 2V brush drop. Calculate the speed for a no-load current of 6A. [15]
7. Derive the condition for maximum torque and the value of maximum torque of a three phase induction motor. [15]
8. Explain the construction and principle of operation of moving coil permanent magnet instruments. [15]

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SET - 3

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- 1.a) Calculate the equivalent resistance in the below circuit (shown in Figure 1).

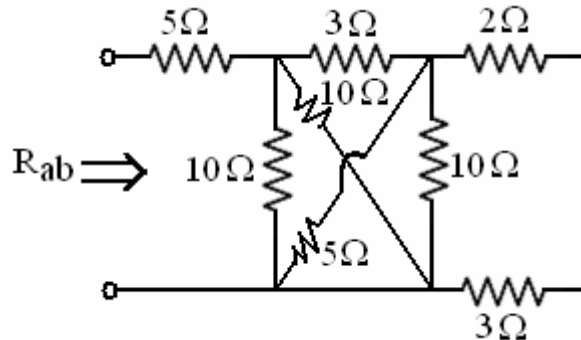


Figure 1

- b) Find current 'I' in the below circuit (shown in Figure 2).

[8+7]

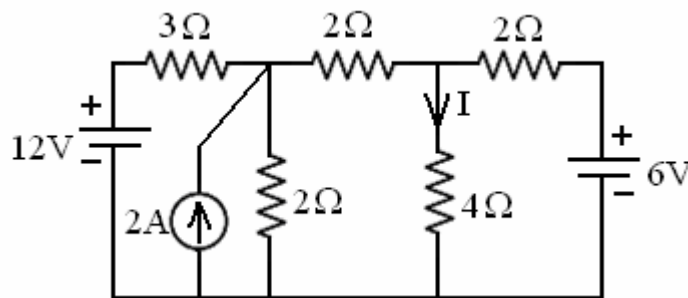


Figure 2

- 2.a) State and explain maximum power transfer theorem.  
 b) Find the voltages across the two current sources in the below circuit (shown in Figure 3) using super position theorem.

[7+8]

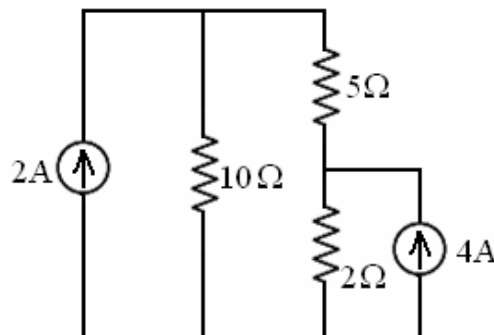


Figure 3

- 3.a) Find the form factor for the below wave form (shown in Figure 4).

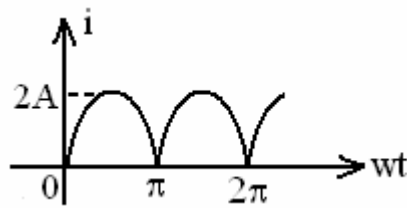


Figure 4

- b) Find  $V(t)$  and  $i(t)$  in the below circuit diagram (shown in Figure 5).

[7+8]

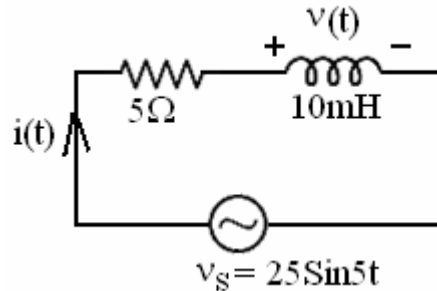


Figure 5

4. A 125 KVA transformer having primary voltage of 2500V at 50 Hz has 270 primary and 50 secondary turns. Neglecting losses, calculate
  - i) The no-load secondary induced emf
  - ii) Full load primary and secondary currents.
 [15]
- 5.a) Derive the EMF equation of a DC generator.
- b) In a given DC generator  $P = 6$ ,  $Z = 400$ ,  $N = 500$  rpm and  $\Phi = 150$  mwb, then calculate the generated EMF when the armature winding in
  - i) lap
  - ii) wave.
 [7+8]
6. A 50KVA, 1 $\Phi$ , 2300V/230V transformer has the primary and secondary winding resistances are  $2\Omega$  and  $0.02\Omega$  respectively. The iron losses are 450W. Calculate the efficiency of the transformer at half load and full load at p.f. of 0.8. [15]
7. Explain the principle of operation and constructional details of three phase induction motor. [15]
- 8.a) Write the essential features of measuring instruments.
- b) With a neat diagram explain the operation of moving Iron attraction type instrument. [7+8]

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- 1.a) State and explain KCL and KVL.  
 b) Find  $V_1$  and  $V_2$  in the below circuit (shown in Figure 1).

[7+8]

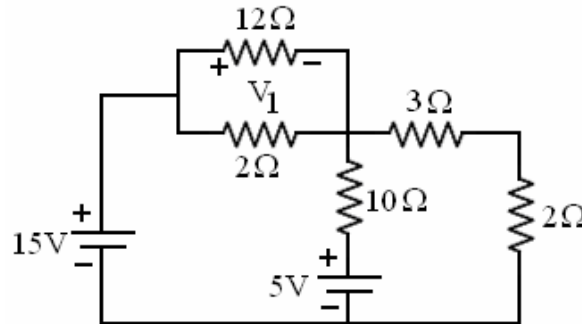


Figure 1

- 2.a) State and explain Super position theorem.  
 b) Determine the Thevenin's equivalent circuit across the terminals 'ab' (shown in Figure 2).

[7+8]

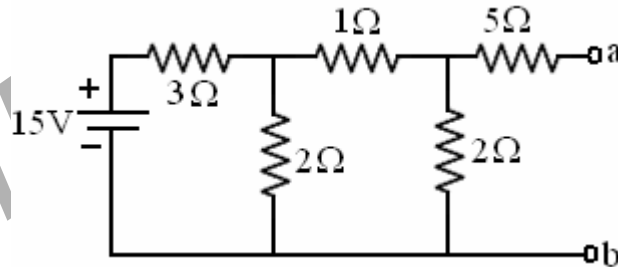


Figure 2

- 3.a) Calculate the RMS value of the voltage wave form shown below in Figure 3.

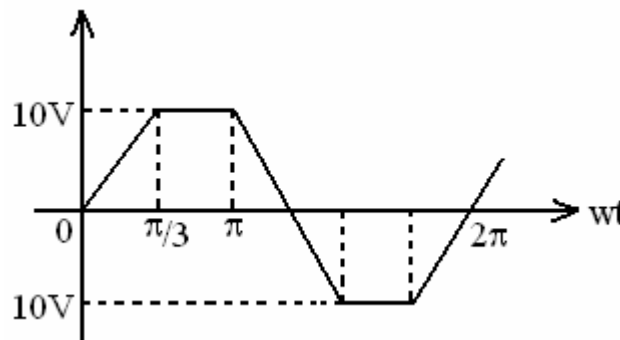


Figure 3

- b) Determine the impedance, phase and current in the below circuit (shown in Figure 4).

[7+8]

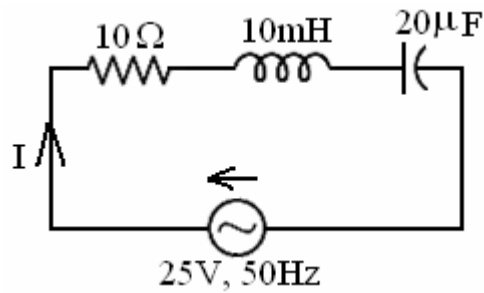


Figure 4

- 4.a) Draw the phasor diagram of a single phase transformer under lagging load conditions.
- b) In a  $1\phi$ , 50Hz, 11000/400V transformer the maximum flux density is  $1.5 \text{ wb/m}^2$  and number of primary turns is 1400. Then calculate
  - i) the number of secondary turns
  - ii) the area of cross section of core. [7+8]
5. Explain the principle of operation of DC generators and also derive its generated emf equations. [15]
6. Explain the various speed controlling methods of DC motor. [15]
- 7.a) Draw the Torque-Speed characteristics of a  $3\phi$  Induction motor.
- b) A  $3\phi$ , 50 Hz induction motor with 6-poles runs at 970rpm. Calculate
  - i) percentage slip
  - ii) frequency of rotor induced emf. [7+8]
8. Explain the classification and essential features of measuring instruments. [15]

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