

Department of Mechanical Engineering

Sessional 1st (Mechanical Engg. and Robotics & AI Engg. 1st Semester)
Basic Electrical Technology (ESC101A)

Time: 1:30 hrs

M. Marks: 15

Note: Part –Attempt any three questions.

- Q.1) By using mesh analysis, determine the current supplied by each battery in the given (5) circuit. (CO1)

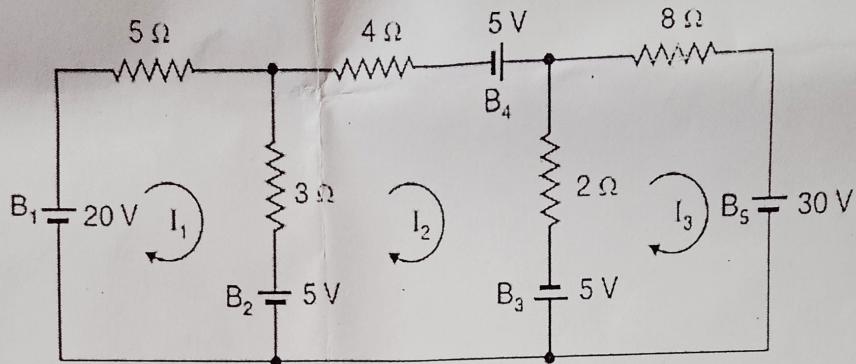


Fig-1

- Q.2) State and explain maximum power transfer theorem. Derive the condition for (5) maximum power transfer. State the applications of maximum power transfer theorem. (CO1)
- Q.3) Determine voltage across the 4Ω resistor using superposition theorem, in the circuit (5) shown in Fig.2 (CO1)

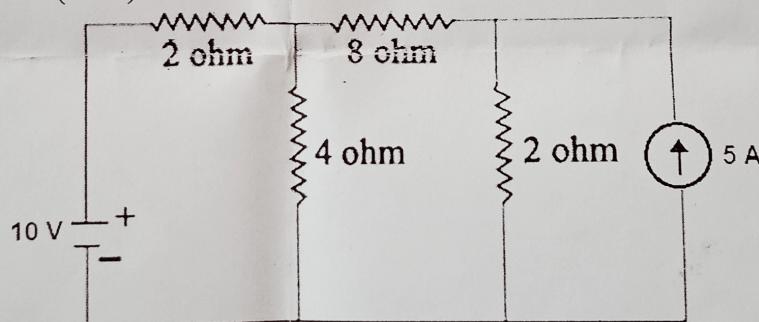


Fig-2

- Q.4) Determine the current flowing in 4 ohm resistance using Thevenin's theorem in the (5) network shown in fig.3 (CO1)

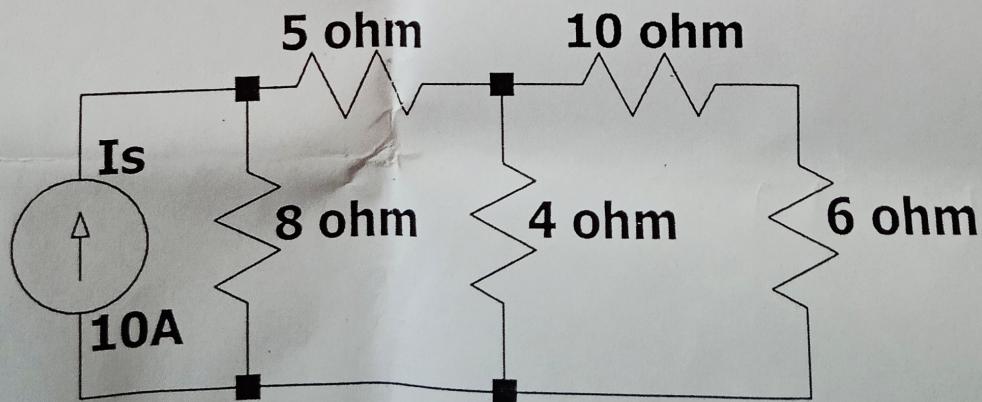


Fig-3

J.C. Bose University of Science and technology, YMCA, Faridabad
B. Tech 1st semester Mechanical Engineering
Sessional 2nd (Electrical Technology (ESC-101))

Max. Time 90 minutes

Note. Attempt any three questions.

Max. Marks 15

- Q1. A resistance of 20Ω and a coil of inductance 31.8 mH and negligible resistance are connected in parallel across 230 V , 50 Hz supply. Find (i) the line current (ii) power factor and power consumed by the circuit 5
- Q2. What is series resonance? Derive the expression for resonant frequency in R-L-C series circuit. 5
- Q3. Draw and explain the two wattmeter method of power measurement in a three phase circuit. 5
- Q4. Derive emf equation for single phase transformer. Draw phasor diagram of single phase transformer for inductive and capacitive load. 5
- Q5. Explain working of auto transformer. What are the advantages of auto transformer over two winding transformer? 5

December 2023
B.Tech. 1st SEMESTER
Basic Electrical Technology (ESC-101-A)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Assume data if missing.*

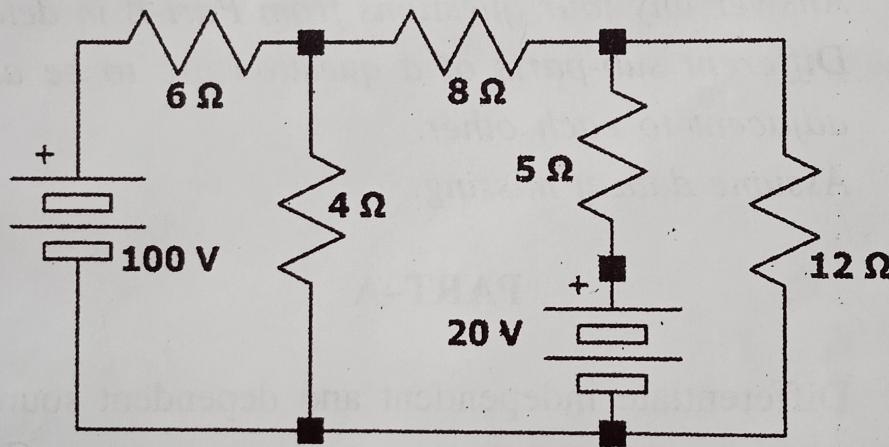
PART-A

1. (a) Differentiate independent and dependent sources. CO1 (1.5)
- (b) What are the limitations of Ohm's law? CO1 (1.5)
- (c) Define unilateral and bilateral circuits. CO1 (1.5)
- (d) Define resonance in series RLC circuit. CO2 (1.5)
- (e) Add $V_1 = (-10 + j 50)$ volts to $V_2 = (30 + j 20)$ volts and express the result in polar form. CO2 (1.5)
- (f) What are the advantages of a three-phase AC system over single-phase? CO2 (1.5)
- (g) What are the applications of auto-transformers? CO2 (1.5)

- (h) Why brushes are made of carbon in a DC machine?
CO3 (1.5)
- (i) What is the function of a fuse in electrical installation?
CO4 (1.5)
- (j) Why earthing is necessary for electrical installations?
CO3 (1.5)

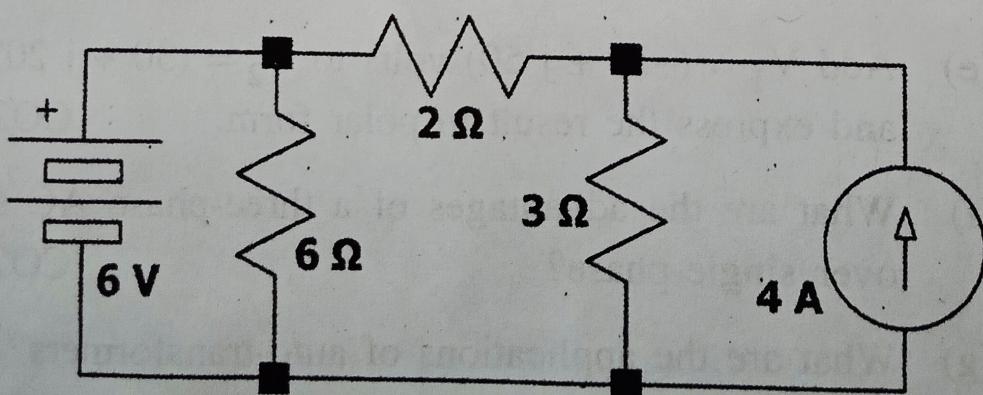
PART-B

2. (a) Using node analysis determine the current in each resistor for the given circuit. CO1 (7.5)

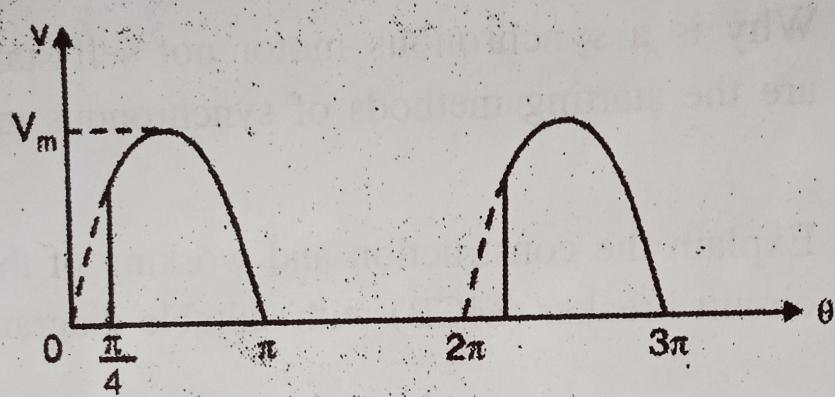


- (b) In the circuit shown in the figure, find the current in 2Ω resistor using the principle of superposition.

CO1 (7.5)



3. (a) Find the average and effective values of the sinusoidal waveform shown in Figure. The maximum value is 100 V. CO2 (7.5)



- (b) A 230V, 50 Hz a.c. supply is applied to a coil of 0.06 H inductance and 6-ohm resistance connected in series with a 6.8 μ F capacitor. Calculate (i) impedance (ii) current (iii) phase angle between current and voltage (iv) power factor and (v) power consumed.

CO2 (7.5)

4. (a) Derive the relationship between line and phase voltage and line and phase current for a star-connected three-phase system with suitable connection and phasor diagrams. CO2 (7.5)

- (b) The power input to a 400 V, 3-phase, 50 Hz induction motor is measured by the two-wattmeter method. The readings of the two wattmeters are 40 kW and -10 kW. Calculate (i) the input power (ii) the power factor and (iii) line current. CO2 (7.5)

5. (a) Define the term magnetic circuit. What are the similarities and dissimilarities between magnetic and electric circuits? CO3 (7.5)

- (b) Explain the working principle of a transformer. What are the properties of an ideal transformer? Draw and explain the phasor diagram of the single-phase transformer at no load condition. CO3 (7.5)
6. (a) Why is a synchronous motor not self-starting? What are the starting methods of synchronous motor? CO3 (7.5)
- (b) Explain the construction and working of the miniature circuit breaker (MCB) with suitable diagram. CO4 (7.5)
7. (a) Define the term power factor. What are the effects of the low power factor? What are the methods of power factor improvement? CO4 (7.5)
- (b) Define the maximum power transfer theorem. Derive the condition for maximum power transfer. CO1 (7.5)
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Time: 3 Hours

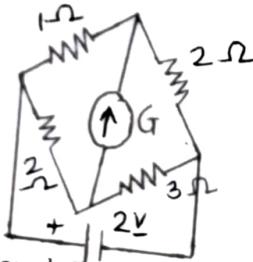
- Instructions:**
1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

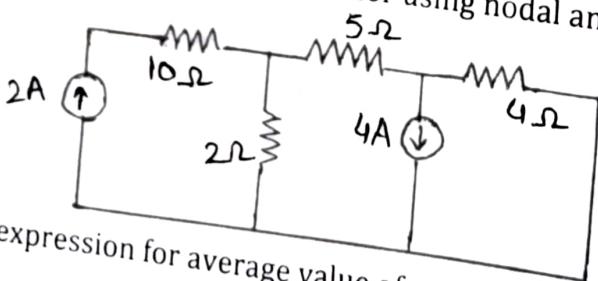
- Q1 (a)** Differentiate between Dynamically induced emf and Statically induced emf. (2)
- (b) Enumerate various limitations of Ohm's law. (2)
- (c) Define the term instantaneous value and rms value of an alternating voltage (2)
- (d) What are unilateral and bilateral circuits? (2)
- (e) Distinguish between active and passive components. (2)
- (f) What do you understand by Q-Factor of a coil? (2)
- (g) Write the merits of three phase system over single phase system. (2)
- (h) Give the comparison of DC Series motor and DC Shunt motor. (2)
- (i) Why the core of a transformer is laminated? Give reason (2)
- (j) What do you understand by the term 'Hysteresis Loss'? (2)

PART -B

- 2 (a)** Calculate the current through the galvanometer in the following bridge using mesh analysis (5)

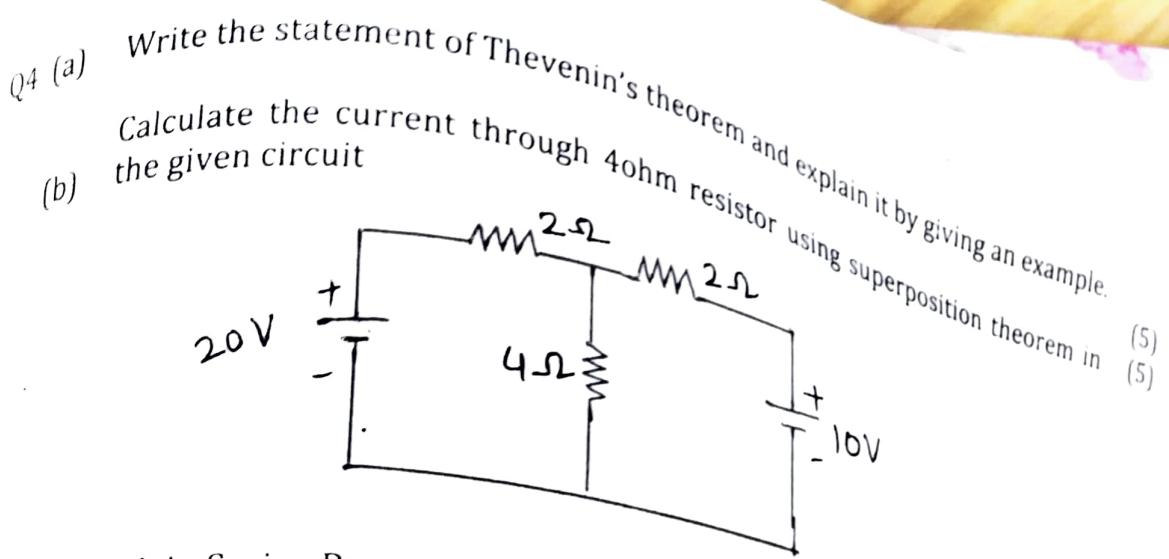


- (b)** Find the current through 5 ohm resistor using nodal analysis (5)



- (c)** Derive the expression for average value of a sinusoidal voltage waveform. (5)

- A sinusoidally varying alternating current of frequency 60 Hz has a maximum value of 15 A. (i) Write the equation for instantaneous value (ii) Find the value of current after 1/200 second. (iii) Find the time taken to reach 10 A for the first time. (5)



- Q5 (a) Explain Series Resonance in a single phase series RLC circuit using appropriate circuit diagram and phasor diagram. (5)
- (b) A 4 ohm resistor is connected to a 10mH inductor across $100\text{V}, 50\text{Hz}$ AC source. Find input current, voltage drop across resistor and inductor, power factor of the circuit and real power consumed. (5)
- (a) Discuss various types of magnetic material along with their properties in detail. (5)
- (b) Describe the two wattmeter method of power measurement in a three phase AC circuit using suitable diagrams. (5)
- Q7 (a) Explain the principle of operation of single phase transformer with a neat sketch. (5)
- (b) Discuss the constructional features of a DC motor by giving suitable diagram (5)

Time: 3 Hours

Max. Marks: 6

- Instructions:**
1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) Differentiate unilateral and bilateral circuits. (2)
- (b) What is the significance of 'j' operator. (2)
- (c) A 60-Hz voltage of 230-V effective value is impressed on an inductance of 0.265 H. Write the time equation for the voltage and the resulting current. (2)
- (d) Define the terms related to magnetic circuits : (i) reluctance (ii) flux density (iii) magnetomotive force (2)
- (e) State Millman's theorem. (2)
- (f) What are the effects of low power factor? (2)
- (g) Define statically and dynamically induced emfs. (2)
- (h) What are the advantages of three phase system over single phase system? (2)
- (i) What is the function of Commutator in a d.c. machine? (2)
- (j) Why transformer cores are laminated? (2)

PART -B

- Q2 (a) Find the current in the branches of the network shown in figure-1 using nodal voltage method. (5)

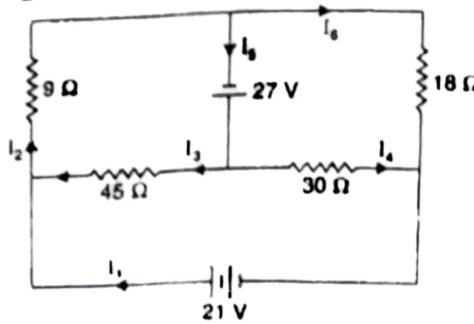


Figure-1

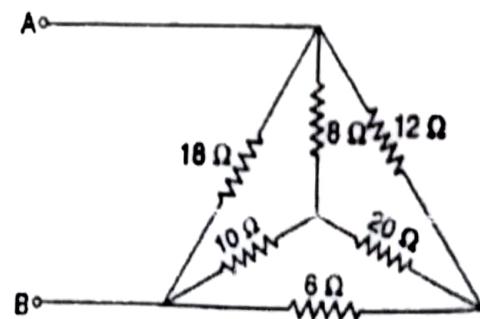


Figure-2

- (b) Figure-2 shows a number of resistances connected in star and delta. Find the resistance across the terminals A and B. Use star/delta conversion method. (5)
- Q3 (a) Find the average value, effective value, form factor and peak factor for the wave shape shown in figure-3 if the curves are parts of a sine wave. (5)

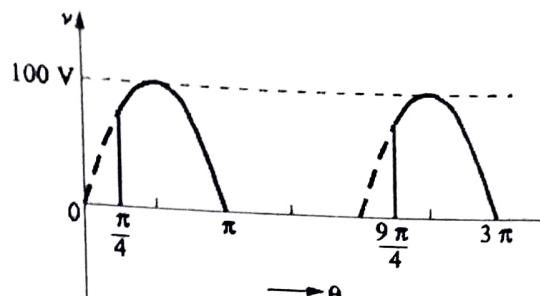


Figure-3

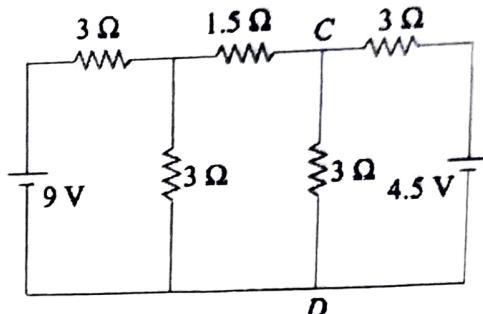


Figure-4

- (b) State and explain maximum power transfer theorem. (5)
- Q4 (a) Find the current through the 3Ω resistance connected between C and D in the circuit shown in figure-4 using superposition theorem. (5)
- (b) Compare electric and magnetic circuits with respect to their similarities and dissimilarities. (5)
- Q5 (a) Two circuits, the impedances of which are given by $Z_1 = 15 + j12$ ohms and $Z_2 = 8 - j5$ ohms are connected in parallel. If the potential difference across one of the impedance is $250 + j0$ V, calculate: (i) total current and branch currents (ii) total power and power consumed in each branch and (iii) overall power-factor and power-factor of each branch. (5)
- (b) What is meant by resonance in series a.c. circuit? Draw resonance curve. Define half power frequencies and quality factor for series resonant circuit. (5)
- Q6 (a) Three identical coils are connected in star to a 400V, three phase, a.c. supply and each coil takes 300W. If the power factor is 0.8 lagging, calculate: (i) the line current (ii) impedance and (iii) resistance and inductance of each coil. (5)
- (b) Explain two wattmeter method of power measurement in three phase system at balance load. What are the effects of power factor on wattmeters reading? (5)
- Q7 (a) Explain the construction and working of three phase induction motor with neat sketches. (5)
- (b) Explain working principle of transformer. Also, derive emf equation of single phase transformer. (5)

Roll No.

Total Pages : 4

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December, 2019
B. TECH. 1st SEMESTER (UNDER CBS)
BASIC ELECTRICAL ENGINEERING (ESC-101)

Time : 3 Hours]

[Max. Marks : 75]

- Note: 1. It is compulsory to answer the questions of Part-A.
2. Limit your answers within 30-50 word in this part.
3. Answer any four questions from Part-B in detail.
4. Different parts of the same question are to be attempted adjacent to each other.*

PART - A

1. (a) A 50 W resistance is connected across a 10 V battery. What is the current through the resistor? Find the energy consumed in 8 s. (1.5)
- (b) The resistance of two wires is 25 W when connected in series and 6 W when joined in parallel. Calculate the resistance of each wire. (1.5)
- (c) An alternating current is represented by $i = 12 \sin 314 t$. Find out (a) Frequency (b) Instantaneous Value at $t = 4$ ms (c) Time taken to attain a value of 10 A for first time after passing through zero. (1.5)

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[P.T.O.
14/12]

- (d) Define duality. What is the dual of capacitance and resistance? (1.5)
- (e) A balanced star-connected load of $(3-4j)\Omega$ is connected to 400 V supply. What is the real power consumed by the load? (1.5)
- (f) Draw and explain equivalent circuit of auto transformer. (1.5)
- (g) Write the principle of operation of DC generator. (1.5)
- (h) Differentiate between buck and boost converter. (1.5)
- (i) Differentiate between MCB and MCCB. (1.5)
- (j) Write down the various characteristics of batteries. (1.5)

PART - B

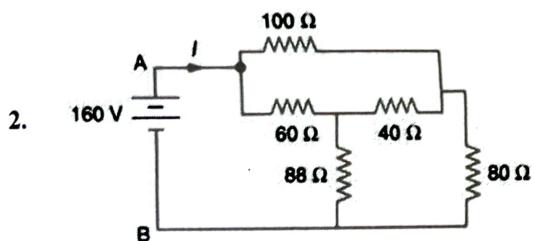


Figure 1(a)

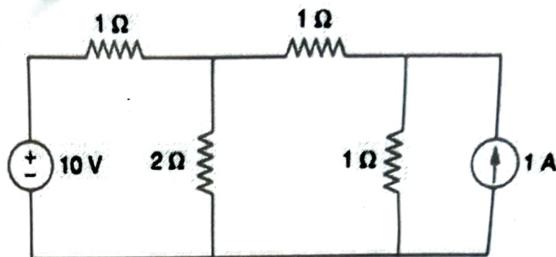
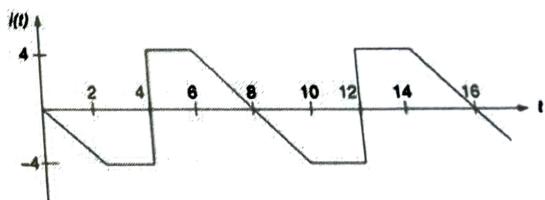


Figure 1(b)

- (a) Determine the current I in the Figure 1(a). (7.5)
- (b) Calculate the current through the 2Ω resistor in the circuit shown in Figure 1(b), using superposition theorem. (7.5)
3. (a) Find the RMS and Average Value of current wave form shown in figure below : (7.5)



- (b) Derive the expression for power factor measurement by using two wattmeter method. Also discuss the various case related to it. (7.5)

4. (a) What is a B-H curve? Explain the hysteresis and eddy current loss. How are they minimized? (7.5)
- (b) Describe efficiency and regulation of single phase transformer with various equations related to them. (7.5)
5. (a) Explain the different types of rotor in three phase induction motor. (7.5)
- (b) What do you mean by synchronous motor? Differentiate synchronous motor from induction motor. (7.5)
6. Write a short note on single phase and three phase voltage source inverter in brief. (15)
7. (a) What do you mean by Earthing? Explain its various types in brief. (7.5)
- (b) Define the term power factor. Write down the various benefits of power factor improvement. (7.5)
-

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BT/II/2018

BASIC ELECTRICAL ENGINEERING
(EE-101C)

Time : 3 Hours]

[Max. Marks : 75]

Instructions :

- (i) *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
- (ii) *Answer any four questions from Part-B in detail.*
- (iii) *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) What is Q factor? (1.5)
- (b) Write various applications of synchronous generator. (1.5)
- (c) What is the necessity of three phase systems? (1.5)
- (d) An alternating current varying sinusoidally with a frequency of 50 Hz has an RMS value of 15 A. What is the instantaneous value of current at 0.0025 secs? (1.5)
- (e) Why the value of load resistance for which maximum power transfer takes place is little greater than that of source resistance? (1.5)

- (f) Why earthing is necessary in AC circuits? (1.5)
- (g) What do you mean by phase sequence in three phase power supply? (1.5)
- (h) What is the difference between autotransformer and potential divider? (1.5)
- (i) How cylindrical pole configuration is different than projected pole of synchronous generator? (1.5)
- (j) Write the condition for which efficiency is maximum for a single phase core type transformer. (1.5)

PART-B

2. (a) Two coils connected in parallel across a 110 V DC supply, take 11 A current from the supply. Power dissipated in one coil is 550 W. What is the resistance of each coil? (4)
- (b) A steel ring has mean diameter of 20 cm, a cross-section of 25 cm^2 and radial air gap 0.8 mm cut across it. When excited by a current of 1 A through a coil of 1000 turns wound on the ring core, it produces an air gap flux of 1 mwb. Neglecting leakage and fringing, calculate : (i) the relative permeability of steel and (ii) the total reluctance of the magnetic circuit. (5)
- (c) Explain the concept of mutual inductance. Define coefficient of coupling and derive an expression for it. (6)

3. (a) Is Tellegen's theorem applicable to AC as well as DC circuits? Explain it with suitable examples. (8)
- (b) State and explain Thevenin's theorem. Determine current i in Fig. 1 using Thevenin's theorem. (7)

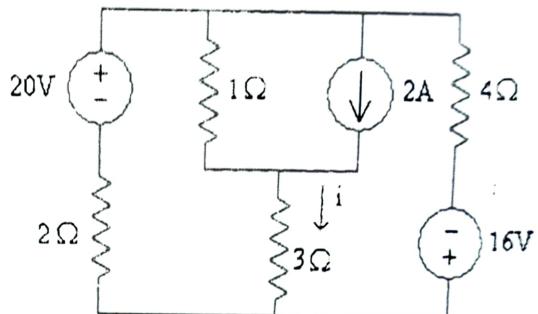


Fig. 1

4. (a) Two coils are connected in series across a 240 V, 50 Hz supply. The resistance of first coil is 5.5 ohm and inductance of second coil is 0.02 H. The active and reactive powers are 2.95 kW and 2.05 kVAR respectively. Find
- the resistance of second coil.
 - the inductance of first coil.
 - the voltage drop across each coil. (10)
- (b) What do you mean by parallel resonance? Determine the expression of resonant frequency using phasor diagram approach. (5)

5. (a) Find the relationship between line and phase values of balanced star and delta connections using labelled phasor diagrams. (7.5)
- (b) Explain two wattmeter method to measure three phase power of delta connected balanced resistive load with suitable circuit diagrams and mathematical expressions. (7.5)
6. (a) A single phase 440 V/110 V, 50 Hz transformer takes a no-load current of 5 A at 0.2 power factor lagging. If the secondary supplies a current of 120 A at a power factor of 0.8 lagging to a load, determine the primary current and the primary power factor. Also draw the phasor diagram. (6)
- (b) How the core losses affect the power factor and efficiency of a single phase transformer? (5)
- (c) Explain principal of operation of synchronous generator. (4)
7. (a) Describe the working principle of DC generator with suitable diagram. What are different applications of DC machines (motor as well as generator)? (7.5)
- (b) Why magnetic field is rotated in air gap when three phase supply is applied across stator winding of three phase induction motor? Explain it with suitable phasor diagrams. (7.5)

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May 2019

B.Tech. 1/2 SEMESTER
Electrical Technology (E-105)

Time 3 Hours

Max. Marks:60

- Instructions:**
1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) State limitations of ohm's law? (2)
(b) Define quality factor of a coil? (2)
(c) What are 1. Form factor 2. Peak factor (2)
(d) Explain reciprocity theorem? (2)
(e) Why double earthing is required for earthing of power equipment? (2)
(f) What is power factor? Discuss the practical importance of power factor? (2)
(g) What are the features of resonance in parallel circuits? (2)
(h) What are the advantages of three - phase system over single-phase system? (2)
(i) What is the function of commutator in DC machines? (2)
(j) Give three industrial uses of 3-phase induction motor? (2)

PART -B

- Q2 (a) State and explain superposition theorem with its limitations? (10)
(b) Explain the difference between Nodal analysis and mesh analysis to solve a given network? (5)
- Q3 (a) Differentiate between statically induced emf , and dynamically induced emf? (5)
(b) Determine rms value, average value, form factor and peak factor for full wave rectified sinusoidal voltage. (10)
- 4 (a) State and explain Millimens theorem using suitable example? (10)
(b) Deduce analogy between magnetic circuit and electric circuit. What are the major points of difference between them? (5)
- 5 (a) A coil of P.F. 0.8 is in series with a 100 microfarad capacitor. When connected to a 50 Hz supply the voltage across the capacitor is equal to the voltage across the coil. Find the resistance and inductance of the coil? (5)
(b) A parallel circuit consists of a coil having 15 ohm resistance and 300 mH inductance in parallel with a capacitor of capacitance 4 microfarad. Determine (1) the resonant frequency (2) Dynamic impedance of the circuit (3) Q-factor of the circuit at resonance. (10)

- Q6 (a) Write down the relationship between line voltage and line current with phase voltage and phase current in star-connected circuits? (5)
- (b) Three similar coils each having a resistance of 15 ohm and an inductance of 0.04 H are connected in star to a 3-phase 50HZ supply, 200 volts between the lines. Calculate the line current. If they are now connected in delta, calculate the phase current, line current and the total power absorbed in each phase. (10)
- Q7 (a) Explain the construction, and working principle of single-phase transformer? (10)
- (b) Explain why a synchronous motor is not self-starting and give one method of starting the synchronous motor? (5)

4. (a) What is a B-H curve? Explain the hysteresis and eddy current loss. How are they minimized? (7.5)

(b) Describe efficiency and regulation of single phase transformer with various equations related to them. (7.5)

5. (a) Explain the different types of rotor in three phase induction motor. (7.5)

(b) What do you mean by synchronous motor? Differentiate synchronous motor from induction motor. (7.5)

6. Write a short note on single phase and three phase voltage source inverter in brief. (15)

7. (a) What do you mean by Earthing? Explain its various types in brief. (7.5)

(b) Define the term power factor. Write down the various benefits of power factor improvement. (7.5)

Roll No.

Total Pages : 4

300111

December, 2019

**B. TECH. 1st SEMESTER (UNDER CBCS)
BASIC ELECTRICAL ENGINEERING (ESC-101)**

Time : 3 Hours]

[Max. Marks : 75]

*Note: 1. It is compulsory to answer the questions of Part-A.
2. Limit your answers within 30-50 word in this part.
2. Answer any four questions from Part-B in detail.
3. Different parts of the same question are to be attempted adjacent to each other.*

PART - A

1. (a) A 50 W resistance is connected across a 10 V battery. What is the current through the resistor? Find the energy consumed in 8 s. (1.5)
(b) The resistance of two wires is 25 W when connected in series and 6 W when joined in parallel. Calculate the resistance of each wire. (1.5)
(c) An alternating current is represented by $i = 12 \sin 314 t$. Find out (a) Frequency (b) Instantaneous Value at $t = 4$ ms (c) Time taken to attain a value of 10 A for first time after passing through zero. (1.5)

- (d) Define duality. What is the dual of capacitance and resistance? (1.5)
- (e) A balanced star-connected load of $(3-4j)\Omega$ is connected to 400 V supply. What is the real power consumed by the load? (1.5)
- (f) Draw and explain equivalent circuit of auto transformer. (1.5)
- (g) Write the principle of operation of DC generator. (1.5)
- (h) Differentiate between buck and boost converter. (1.5)
- (i) Differentiate between MCB and MCCB. (1.5)
- (j) Write down the various characteristics of batteries. (1.5)

PART - B

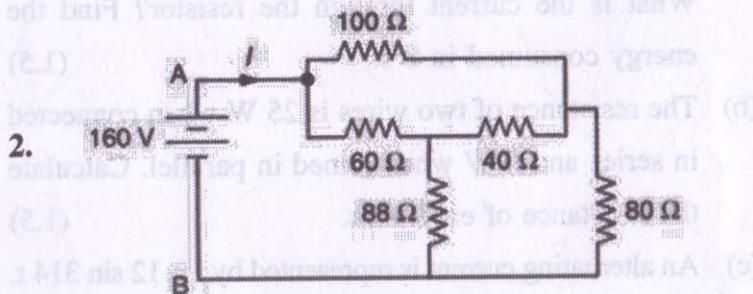


Figure 1(a)

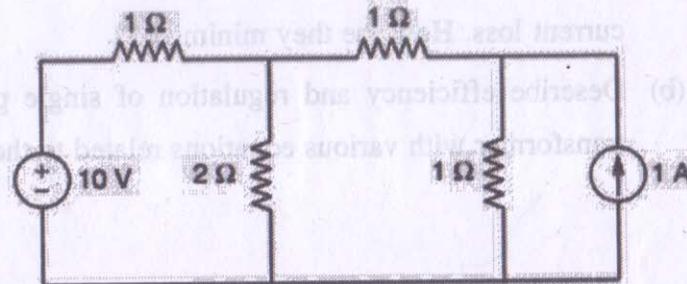
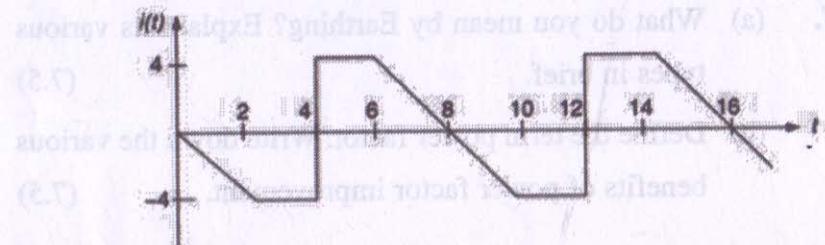


Figure 1(b)

- (a) Determine the current I in the Figure 1(a). (7.5)
- (b) Calculate the current through the 2Ω resistor in the circuit shown in Figure 1(b), using superposition theorem. (7.5)

3. (a) Find the RMS and Average Value of current wave form shown in figure below : (7.5)



- (b) Derive the expression for power factor measurement by using two wattmeter method. Also discuss the various case related to it. (7.5)

300210**October, 2020****B.Tech.-II SEMESTER****Basic Electrical Engineering (ESC-101)**

Time : 3 Hours]

[Max. Marks : 75]

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART - A

1. (a) Distinguish between loop and mesh in an electrical network with suitable circuit. CO1 (1.5)
(b) State Norton's theorem. CO1 (1.5)
(c) The equation of an alternating current is $i = 282.8 \sin 377t$. What is rms value of current and frequency? CO2 (1.5)
(d) What are the properties of parallel resonance circuit? CO2 (1.5)

- (e) Give the relationship between magnetic field intensity and magnetic flux density. CO3 (1.5)
- (f) What are the properties of an ideal transformer? CO3 (1.5)
- (g) Define voltage regulation of a transformer. CO3 (1.5)
- (h) What are the speed control methods of DC motor? CO3 (1.5)
- (i) How ELCB work in the circuit? CO4 (1.5)
- (j) What kind of protection is offered by a fuse? CO4 (1.5)

PART - B

2. (a) Calculate the current in each branch of the circuit shown in Fig. 1. CO1 (7)

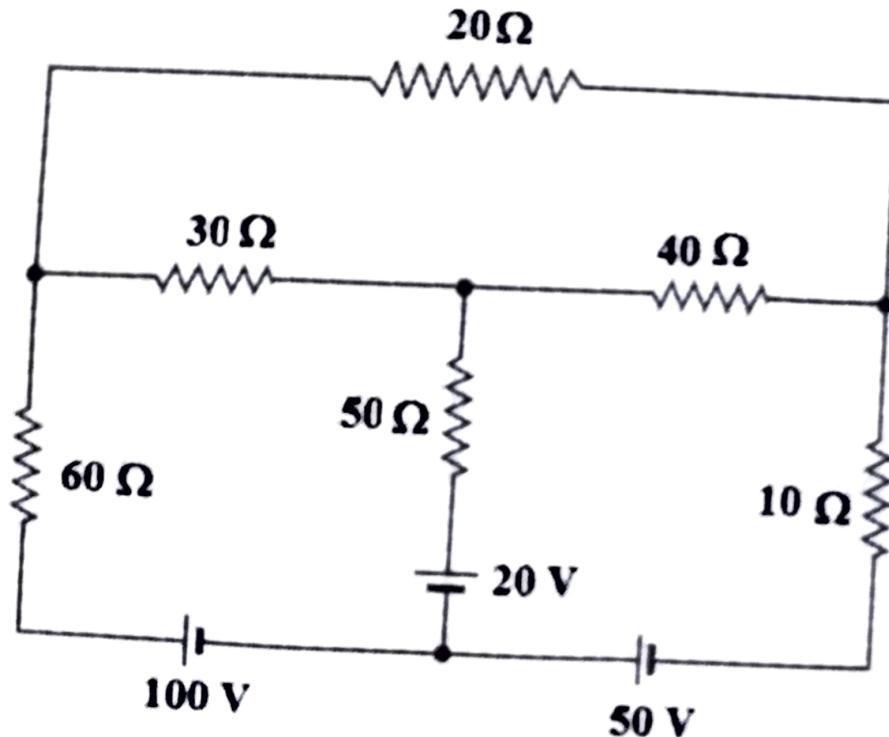


Fig. 1.

- (b) By using Thevenin theorem, find current I in the circuit shown in Fig. 2. CO1 (8)

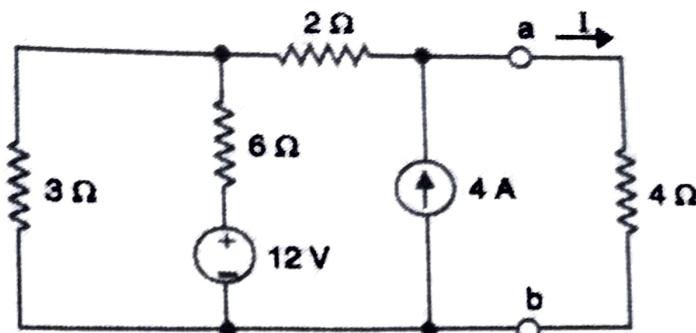


Fig. 2.

3. (a) Find the rms value, average value, form factor and peak factor of the voltage waveform shown in Fig. 3. CO2 (7)

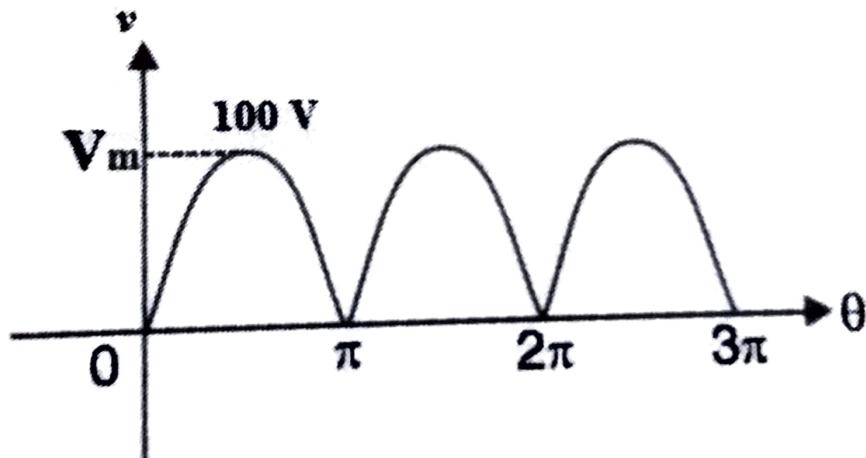


Fig. 3

- (b) A 150 V dc is applied to a circuit consisting of a resistance of 50Ω in series with an inductance of 10 H through the switch. If the switch is closed at $t = 0$, find out (i) the expression for current $i(t)$, voltage drop across resistor $v_R(t)$ and voltage drop across inductor $v_L(t)$ (ii) the value of $i(t)$ for $t = 0.25$ second and (iii) time at which $v_R(t) = v_L(t)$. CO1 (8)

[P.T.O.]

4. (a) 230 V, 50 Hz a.c. supply is applied to a coil of 0.06 H inductance and 2.5Ω resistance connected in series with a $6.8 \mu\text{F}$ capacitor. Calculate (i) impedance (ii) current (iii) power consumed (iv) power factor and (v) voltage drop across each element. CO2 (5)

(b) Obtain the relationship between phase voltage and line voltage, phase current and line current for delta connection in three phase system. CO2 (5)

(c) A 50 kVA loss less transformer has 500 turns on the primary and 40 turns on the secondary winding. The primary is connected to 3300 V, 50 Hz mains. Determine (i) primary and secondary current at full load; (ii) secondary emf and (iii) the maximum flux in the core, No load current can be neglected. CO3 (5)

5. (a) What are the losses occurring in a transformer? Write an expression for calculating the efficiency of a transformer and develop the condition for maximum efficiency. CO3 (7)

(b) Explain auto transformer with suitable diagram. Compare it with two winding transformer and what are its applications? CO3 (8)

6. (a) With the help of neat diagram discuss the various parts of a dc machine. CO3 (8)

- (b) What do you understand by earthing? Why it is necessary in electrical installations? Explain pipe earthing with suitable sketch. CO4 (7)
7. (a) What is a dc chopper? Discuss with necessary circuit diagram the principle of operation of a step down and step up chopper. CO3 (8)
- (b) What is MCCB? Explain its functions and working with neat diagram. CO4 (7)
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