BEE-01

Roll No. 2 0 1 8 0 5 1 1 0 2

B. Tech.
(SEM II) EVEN SEMESTER
MAJOR EXAMINATION 2018 - 2019

Principles of Electrical Engineering

Time: 3 Hrs. **Max. Marks: 50**

Note: Attempt all questions. Each question carries equal marks.

1. Attempt any five parts of the following: **(5× 2 = 10)**

(a) Applying Norton's theorem, calculate the value of R that results in maximum power transfer to the 6.2 ohm resistor as shown in Fig. 1. Find the maximum power dissipated by the resistor 6.2 ohm under that situation.

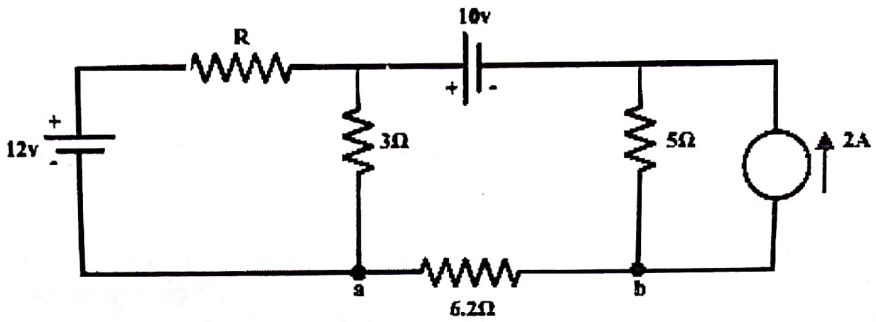

Figure 1

(b) Calculate the average value, effective value and form factor of the output voltage of a half wave rectifier as shown in Fig. 2.

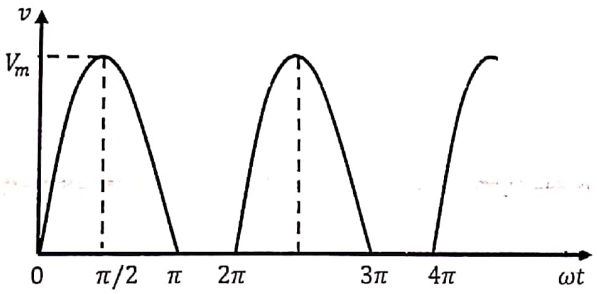

Figure 2

(c) Using Thevenin's theorem, calculate the current flowing through the 4 Ω resistor as shown in Fig. 3.

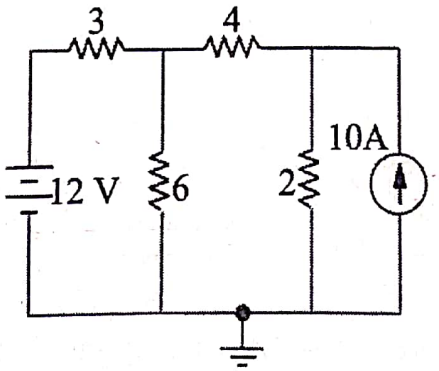

Figure 3

(d) State and prove maximum power transfer theorem for d.c. network with suitable example. Also draw and explain the characteristics between maximum power and load current.

(e) A series LC circuit has Q=70, L=100 pH, and C=2500μF. Find (i) the resonant frequency, (ii) the half-power frequencies, and (iii) bandwidth.

(f) The power in a 3-phase circuit is measured by two watt-meters. If the total power is 100 kW and power factor is 0.66 leading, what will be the reading of each wattmeter? Give the connection diagram for the wattmeter circuit. For what p.f. will one of the wattmeter read zero?

(g) Discuss resonance in R-L-C series circuit. Derive an expression for resonant frequency for R-L-C series circuit.

2. **Attempt any two parts of the following:** **(2× 5 = 10)**

(a) Explain the principle of operation, construction and the expression for deflection of a moving iron instrument. Why does a MI instrument have non-linear scale? Explain its advantages and disadvantages and application.

(b) Distinguish between the following three types of measuring instruments: *(i) deflecting type; (ii) recording type and (iii) integrating type.* Discuss the working principle and constructional features of PMMC instrument.

(c) A 200 kVA transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at three quarters of full load, calculate the efficiency at half load. Assume negligible magnetising current and power factor of 0.8 at all loads.

3. **Attempt any two parts of the following:** **(2× 5 = 10)**

(a) At 400 V and 50 Hz the total core loss of a transformer was found to be 2400 W. When the transformer is supplied at 200 V, and 25 Hz, the core loss is 800 W. Calculate the hysteresis loss and eddy current loss at 400 V and 50 Hz and also explain hysteresis and eddy-current loss.

(b) Define the following terms:

(i) MMF (ii) Reluctance (iii) Magnetic potential (iv) Magnetisation curve (v) flux density (vi) Magnetizing force (vii) Susceptibility (viii) Relative permeability (ix) Hysteresis loss (x)Eddy-current loss.

(c) Describe the working of a single phase transformer and derive the e.m.f equation for a single phase transformer. State the advantages and disadvantages of an auto-transformer over two-winding transformer. What are the applications of autotransformer?

4. **Attempt any two parts of the following:** **(2× 5 = 10)**

(a) A 3-phase, 6-pole 50 Hz Induction motor has a slip of 1 % at no-load and 3 % at full-load. Calculate:

(i) Synchronous speed (ii) No-load and full-load speed

(iii) Rotor frequency at No-load and full-load.

(b) Derive the *e.m.f.* equation of dc generator. Explain the difference between the separately-excited and self-excited dc shunt generator. Describe the process of voltage build up in a self-excited shunt generator.

(c) Explain the working of 3-phase induction motor. What is meant by slip? Explain slip-torque characteristics of 3-phase induction motor.

Attempt any two parts of the following: **(2× 5 = 10)**

(a) Draw magnetization characteristics of a dc shunt generator and explain process of building up an emf. Under what conditions the generator does not develop induced emf. Suggest a remedy for each case

(b) Explain the principle of operation of a 3-phase synchronous motor. State the applications of synchronous motor and compare the synchronous motor with induction motor.

(c) A 240 V dc series motor takes 40 A when giving its rated output at 1500 rpm. Its resistance is 0.3 ohm. Find what resistance must be added to obtain the rated torque *(a) at starting (b) at 800 rpm.*

ECE

BEE-01

Roll No. 2 0 1 7 0 7 1 0 1 6

B. Tech.
ODD SEMESTER
MAJOR EXAMINATION 2017 - 2018

Principles of Electrical Engineering

Time: 3 Hrs. Max. Marks: 50

Note: Attempt all questions. Each question carries equal marks.

1. Attempt any four parts of the following: $(4\times 2.5 = 10)$

(a) Calculate the direction and magnitude of the current through the 5 Ω resistor between points A and B of Fig. 1 (a) by using nodal voltage method.

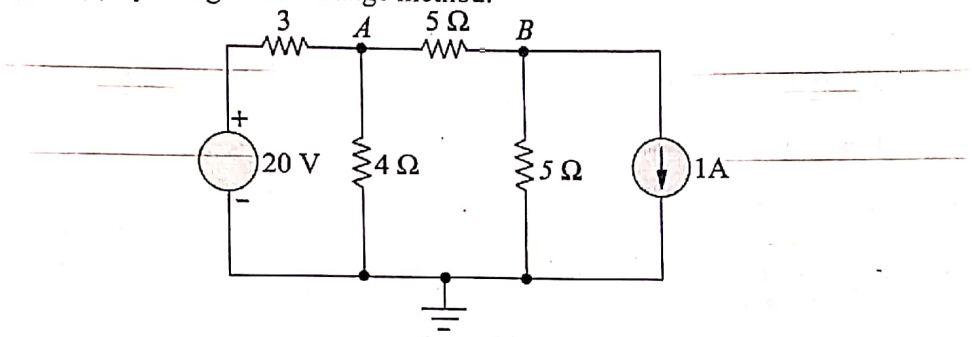

Figure 1 (a)

(b) Using Thevenin's theorem, calculate the current flowing through the 4 Ω resistor of Fig. 1 (b).

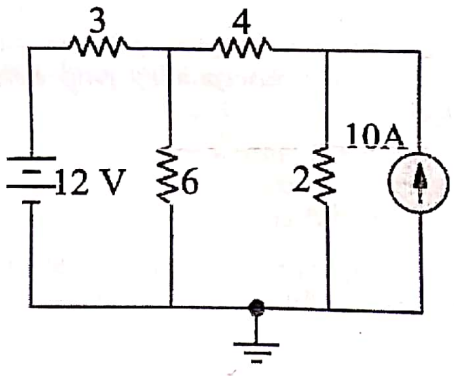

Figure 1 (b)

(c) Explain the duality between a Thevenin's & Norton's equivalent circuit and prove maximum power transfer theorem for dc network.

(d) Calculate the r.m.s., average value, form factor and peak factor of the voltage wave shown in Fig. 1 (c).

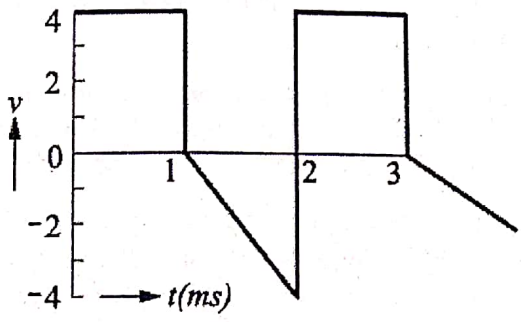

Figure 1 (c)

(e) A series R-L-C circuit is excited from a constant-voltage variable frequency source. The current in the circuit becomes maximum at a frequency of $600/2\pi$ Hz and falls to half the maximum value at $400/2\pi$ Hz. If the resistance in the circuit is 3 Ω, find L and C.

(f) A balanced star-connected inductive load is connected to a 400 V, 50 Hz ac supply. Two wattmeter used to measure supply power indicate 8,000 W and 4,000 W respectively. Determine:

(i) Line current (ii) impedance of each phase (iii) resistance and inductance of each phase

2. Attempt any two parts of the following: **$(2\times 5 = 10)$**

(a) Distinguish between the following three types of measuring instruments: *(i) deflecting type; (ii) recording type and (iii) integrating type.* Discuss the working principle and constructional features of PMMC instrument.

(b) Explain the principle of operation, construction and the expression for deflection of a moving iron instrument. Why does a MI instrument have non-linear scale? Explain its advantages and disadvantages and application.

(c) A flux of 0.5 mWb is produced by a coil of 900 turns wound on a ring with a current of 3 A in it. Calculate *(i) the inductance of the coil (ii) the e.m.f. induced in the coil when a current of 5 A is switched off, assuming the current to fall to zero in 1 milli second and (iii) the mutual inductance between the coils,* if a second coil of 600 turns is uniformly wound over the first coil.

3. Attempt any two parts of the following: **$(2\times 5 = 10)$**

(a) Define the following terms:
(i) MMF (ii) Reluctance (iii) Magnetic potential (iv) Magnetisation curve (v) flux density (vi) Magnetizing force (vii) Susceptibility (viii) Relative permeability (ix) Hysteresis loss (x)Eddy-current loss.

(b) State and explain the *e.m.f.* equation of single-phase transformer? Differentiate between two winding transformer and autotransformers? Mention any two application of shell type single-phase transformer and pros & cons of auto-transformer.

(c) A 200 kVA transformer has an efficiency of 98% at full load. If the maximum efficiency occurs at three quarters of full load, calculate the efficiency at half load. Assume negligible magnetising current and power factor of 0.8 at all loads.

4. Attempt any two parts of the following: **$(2\times 5 = 10)$**

(a) (i) A dc shunt motor with an armature resistance of 0.2 ohm derives a load at 1245 rpm drawing an armature current of 125 A from a 440 V supply. If the excitation is reduced to 75% of initial value and the total torque developed by the armature remains unaltered, calculate the new speed.

(ii) A 240 V dc series motor takes 40 A when giving its rated output at 1500 rpm. Its resistance is 0.3 ohm. Find what resistance must be added to obtain the rated torque *(a) at starting (b) at 1,000 rpm.*

(b) Derive the *e.m.f.* equation of dc generator. What are lap and wave windings? Describe the difference between the separately-excited and self-excited shunt generator. Explain the process of voltage build up in a self-excited shunt generator.

(c) Explain the construction and working principle of 3-phase induction motor. Explain why the rotor of induction motor cannot run at synchronous speed.

Attempt any two parts of the following: **(2× 5 = 10)**

(a) An 8-pole, 50 Hz induction motor is running at 4% slip when delivering full-load torque. It has standstill rotor resistance of 0.1 ohm and reactance of 0.6 ohm/ phase. Calculate the speed of the motor if an additional resistance of 0.5 ohm/ phase is inserted in the rotor circuit. The full-load torque remains constant.

(b) Discuss constructional details and principle of operation of a synchronous machine. Explain the basic difference between a synchronous machine and a dc machine?

(c) A full-load current of 100 A requires an excitation current of 3 amperes when a single phase 1200 V alternator is short-circuited by an ammeter of resistance 0.01 ohm. On open-circuit the same excitation produces 350 V. The resistance of the armature is 0.5 ohm. Calculate the regulation of the alternator at 0.8 power factor leading.

Printed pages: 2

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BEE-01

Name of Course: B. Tech.
Year: 1st Semester: I
Major Examination: 2016-17
Principles of Electrical Engineering

Time: 3 Hrs. Max. Marks: 40

Note: Attempt all Questions. Each question carries equal marks.

1. Attempt any three parts of the following. Q.1(a) is compulsory.

(a) Find the value of the voltage source (V_s) that delivers 4 Amps current through the circuit as shown in Fig.1. Using star-delta transformation. [4]

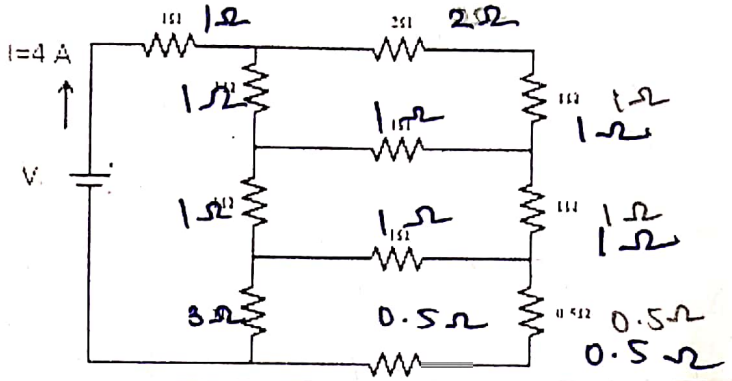

Fig. 1

(b) State and prove maximum power transfer theorem for d. c. network. [3]

(c) For the circuit shown in Fig.2, find the current through resistor $R_L=R_2=1$ *ohm* resistor ($I_{a\text{-}b}$ branch) using Thevenin's theorem & hence calculate the voltage across the current source (V_{cg}). [3]

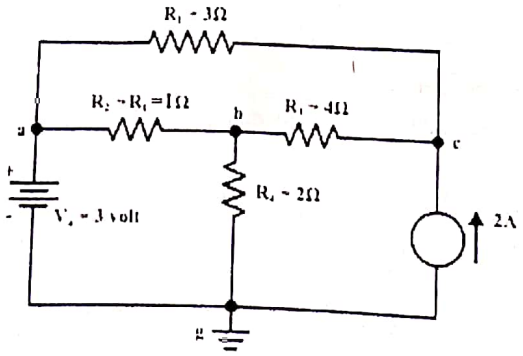

Fig. 2

(d) Explain the following with suitable schematic diagram and characteristics. [3]

i. Linear and Nonlinear Elements.
ii. V-I characteristics of Ideal & Practical voltage and current sources.
iii. Merits and demerits of Superposition Theorem.

2. Attempt any three parts of the following. Q.2(a) is compulsory.

(a) What are the various methods of measuring power in 3-phase circuits? Explain and draw the phasor diagram of 2-wattmeter method and show that these two wattmeter can read the true power in a 3-phase system. [4]

(b) Calculate the average value, effective value and form factor of the output voltage of a half wave rectifier as shown in Fig. 3. [3]

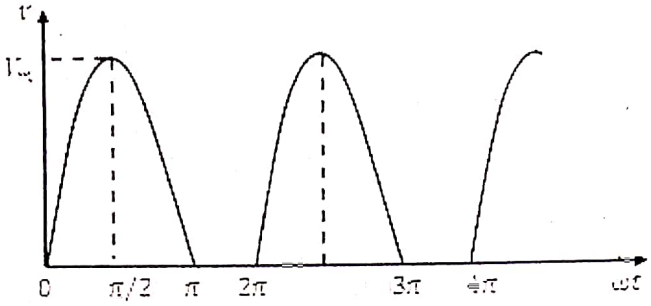

Fig.3

(c) A 10 mH coil is connected in series with a loss-free capacitor to a variable-frequency source which supplies a constant voltage of 10 V. The circuit current has a maximum value of 0.1 A at a frequency of 80 kHz. Calculate: [3]

(i) the capacitance of the capacitor
(ii) the Q factor of the coil, and
(iii) the half-power frequencies

(d) What are the necessity and advantage of using 3-phase system? Derive $I_l = \sqrt{3} I_{ph}$ for delta connection. [3]

3. Attempt any three parts of the following. Q.3(a) is compulsory.

(a) Explain the working of a single phase transformer and derive the e.m.f equation for a single phase transformer. [4]

(b) Discuss the construction and principle of operation of a moving iron type measuring instrument. Also enlist advantages and disadvantages of it. [3]

(c) Explain the constructional details and working principle of PMMC instrument. Explain why PMMC type instruments belong to linear scale type instrument. [3]

(d) Explain the working principle of auto-transformer. What are its advantages, disadvantages and applications? [3]

4. Attempt any three parts of the following. Q.4(a) is compulsory.

(a) Explain the constructional details and working principle of 3-phase induction motor. [4]

(b) A 3-phase, 4-pole Induction motor is supplied from 3-phase, 50Hz ac supply. Calculate: [3]

(i) Synchronous speed
(ii) The rotor speed when slip is 6%
(iii) The rotor frequency when rotor runs at 800 rpm.

(c) Describe why it is beneficial to place field winding on rotor and armature winding on stator in a 3-phase synchronous generator. [3]

(d) Discuss the working principle of a 3-phase synchronous machine. Also differentiate synchronous motor from induction motor. [3]