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**BTECH**  
**(SEM I) THEORY EXAMINATION 2023-24**  
**FUNDAMENTALS OF ELECTRICAL ENGINEERING**

TIME: 3HRS

M.MARKS: 70

**Note: 1.** Attempt all Sections. If require any missing data; then choose suitably.

**SECTION A**

**1. Attempt all questions in brief.**

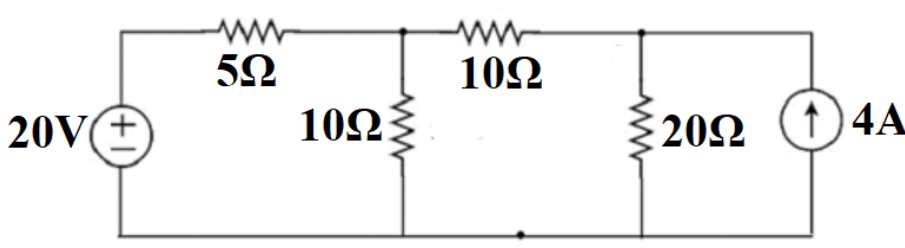
**2 x 7 = 14**

Q no.	Question	Marks	CO
a.	Differentiate between ideal voltage source and practical voltage source.	2	1
b.	Describe briefly the following elements with examples: (i) Unilateral and Bilateral elements. (ii) Active and Passive elements.	2	1
c.	Derive that the average power consumed by a pure inductor is zero.	2	2
d.	In a series RLC circuit, $R = 2\Omega$ , $L = 2\text{mH}$ , $C = 10\mu\text{F}$ . Find the resonant frequency and Q-factor.	2	2
e.	Find the inductance of a coil in which a current of 0.2A increasing at a rate of 0.4 A/sec represents a power flow of 0.4 watt.	2	3
f.	What is the function of slip rings in 3- $\phi$ induction motor?	2	4
g.	What are the common problems that occur during electrical installations?	2	5

**SECTION B**

**2. Attempt any three of the following:**

**7 x 3 = 21**

Q no.	Question	Marks	CO
a.	Calculate the current across $20\Omega$ resistor using nodal analysis in the following circuit: 	7	1
b.	Calculate the form factor and peak factor for a half-wave rectified voltage signal.	7	2
c.	A 100 kVA, 1- $\phi$ transformer has iron loss of 600 W and a copper loss of 1.5 kW at full-load current. Calculate the efficiency at (i) full load and 0.8 pf (lagging), and (ii) half load and unity pf?	7	3
d.	Describe the working principle and torque-slip characteristics of 3- $\phi$ induction motor.	7	4
e.	Discuss briefly the types of batteries and explain any one type of secondary battery with the necessary diagram.	7	5



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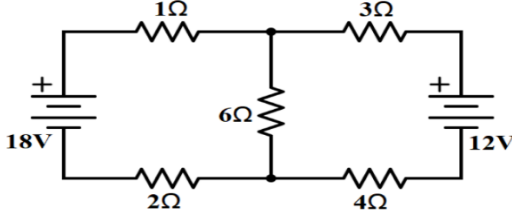
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## SECTION C

**3. Attempt any one part of the following:****7 x 1 = 7**

Q no.	Question	Marks	CO
a.	Calculate the current across $6\Omega$ resistor in the following circuit using: (i) Mesh Analysis (ii) Nodal Analysis 	7	1
b.	Explain the procedure of mesh analysis with the help of an example.	7	1

**4. Attempt any one part of the following:****7 x 1 = 7**

a.	Derive an expression of bandwidth, upper and lower half power frequency of a series resonating circuit.	7	2
b.	Derive the relation between line and phase voltages in a 3- $\phi$ , star-connected circuit. A balanced star-connected load of $(3+j4)\Omega$ /phase is connected to a 3- $\phi$ , 400 V supply. Calculate the line current, power factor, active and reactive power drawn from the supply.	7	2

**5. Attempt any one part of the following:****7 x 1 = 7**

a.	A 20 kVA, 2000V/200V, 1- $\phi$ , 50 Hz transformer has a primary resistance of $1.5\Omega$ and reactance of $2\Omega$ . The secondary resistance and reactance are $0.015\Omega$ and $0.02\Omega$ respectively. The no-load current of transformer is 1A at 0.2 power factor. Determine: (i) Equivalent resistance and reactance referred to primary. (ii) Total copper loss.	7	3
b.	Draw the phasor diagram of ideal and practical transformer at no-load conditions.	7	3

**6. Attempt any one part of the following:****7 x 1 = 7**

a.	Derive the expression of torque for DC motor. A 6 pole lap wound DC shunt motor has 500 conductors in the armature. The resistance of the armature path is $0.05\Omega$ . The resistance of the shunt field is $25\Omega$ . Find the speed of the motor when it takes 120 A from DC mains of 100 V. Flux per pole is 0.02 Wb.	7	4
b.	Why 1- $\phi$ induction motor is not self-starting? What are the methods of starting? Explain any one of them.	7	4

**7. Attempt any one part of the following:****7 x 1 = 7**

a.	Explain the following with neat and labelled diagram: (i) Earth Leakage Circuit Breaker (ii) Miniature Circuit Breaker	7	5
b.	What is the difference between earthing and grounding? Also discuss the different methods of earthing?	7	5