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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.

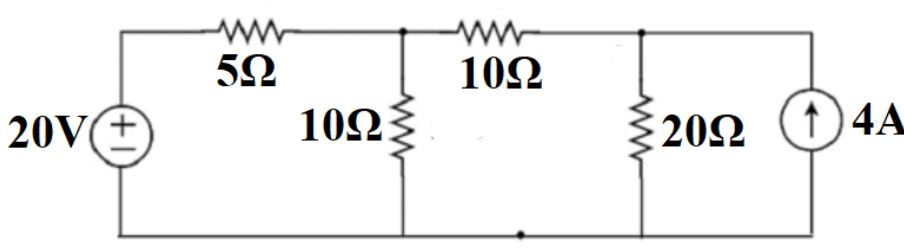
2 x 7 = 14

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- ϕ 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 20Ω 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- ϕ 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- ϕ 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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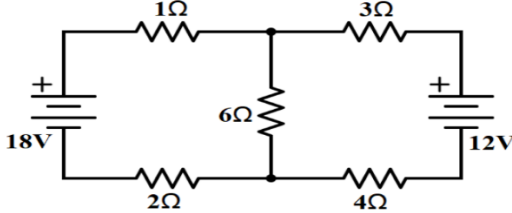
TIME: 3HRS

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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 6Ω 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- ϕ , star-connected circuit. A balanced star-connected load of $(3+j4)\Omega$ /phase is connected to a 3- ϕ , 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- ϕ , 50 Hz transformer has a primary resistance of 1.5Ω and reactance of 2Ω . The secondary resistance and reactance are 0.015Ω and 0.02Ω 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 0.05Ω . The resistance of the shunt field is 25Ω . 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- ϕ 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