Roll No

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

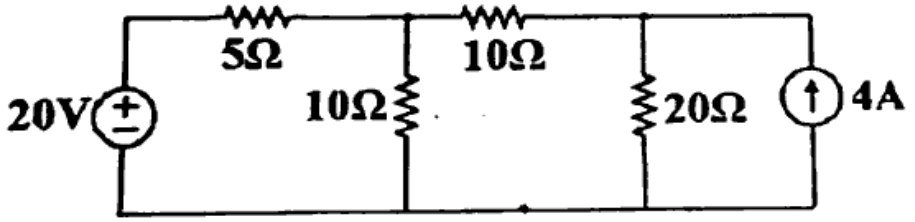
SECTION A

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 =2Ω, L = 2mH, C = 10μF. 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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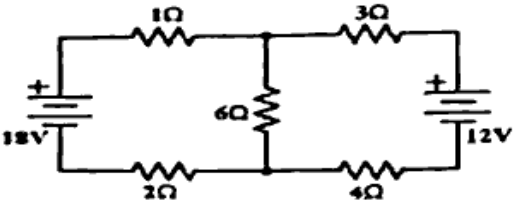
SECTION C

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) Ω/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 1.5 Ω and reactance of 2 Ω. The secondary resistance and reactance are 0.015 Ω and 0.02 Ω 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 Ω. The resistance of the shunt field is 25 Ω. 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