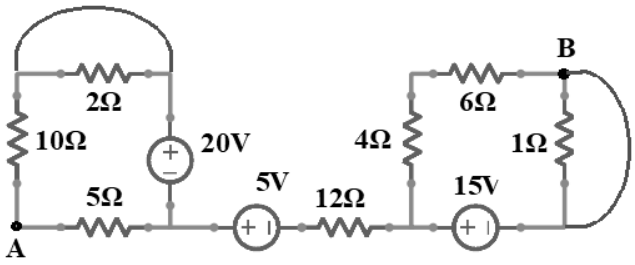
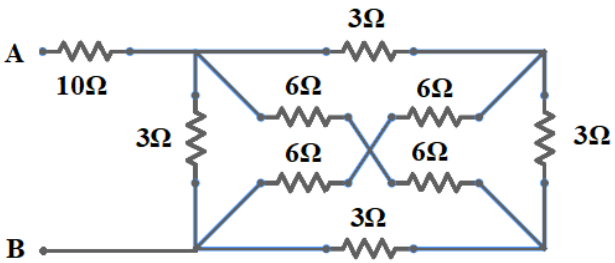
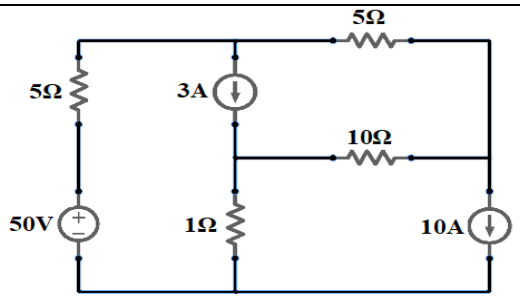
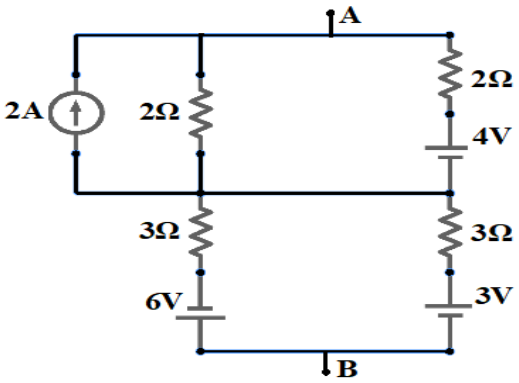
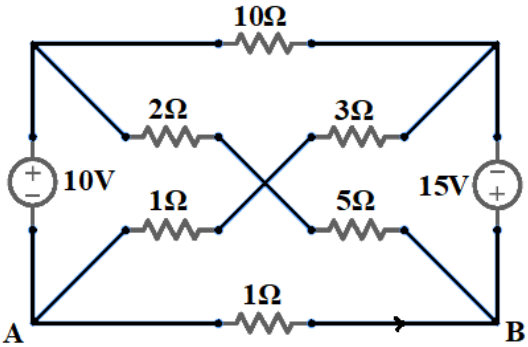
Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous College Affiliated to University of Mumbai)

End Semester Examination
May 2021

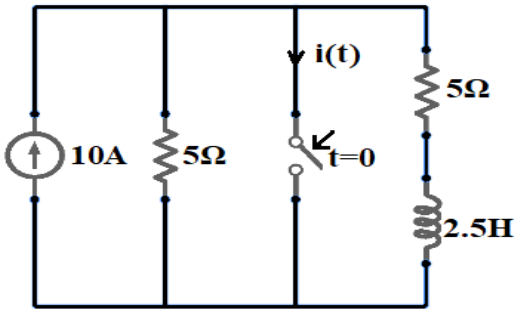
Max. Marks: 60 **Duration: 2 Hrs**
Class: F.Y. **Semester: I**
Course Code: ET101 **Branch: Electronics Engineering & Electronics and Telecommunication Engineering**
Name of the Course: Basic Electrical Engineering

Instructions:
1. **All questions are compulsory, with appropriate internal choice in some questions**
2. **Q.1 and Q. 2: Only Answers with appropriate units are desired, no steps are expected.**
3. **Q. 3 and Q.4: Subjective questions with detailed step-wise solution is expected**
4. **Draw neat diagrams wherever necessary**
5. **Assume suitable data if necessary**

Question No.		Max. Marks	CO
Q 1 (a)	In the given Circuit, the value of V_{AB} is ____ 	**02**	CO-1
Q 1 (b)	The Resistance between Terminal A and B is ____ 	**02**	CO-1
Q 1 (c)	The Current in 10Ω Resistance is ____	**02**	CO-1

			
Q 1 (d)	On converting the given Network to a Voltage Source and Series Resistance between Terminal A and B, the value of Voltage Source and Series Resistance would be ____ and ____ respectively. 	**02**	CO-1
Q 1 (e)	Norton's equivalent Resistance between Terminals A and B is ____ 	**02**	CO-1
Q 1 (f)	A 1-ϕ, 440/220V, 10 kVA, 50 Hz transformer has a resistance of 0.2Ω and reactance of 0.6Ω on H.V. side. The corresponding values of L.V. side are 0.04Ω and 0.14Ω. The percentage regulation on full load for 0.8 leading power factor is _____	**03**	CO-3
Q 1 (g)	A 120 V DC shunt motor draws a current of 200A. The armature resistance is 0.02Ω and shunt field resistance 30Ω. If the lap-wound armature has 90 slots with 4 conductors per slot and flux per pole is 0.04Wb then speed of the motor is _____	**02**	CO-3

Q 2 (a)	A Sine-wave voltage with an instantaneous equation is given as: $v(t) = 100 + 600 \sin(12t) + 200 \cos(36t) + 120 \cos(60t)$. The RMS value of the composite current wave-shape, *i(t)* produced when *v(t)* is applied to a 20 Ohm resistor is given as: _____	**02**	CO-2
Q.2 (b)	When a voltage of 100V at 50 Hz is applied to a choking coil A, the current taken is 8 A and the power is 120 W. When 100 V is applied to another choking coil B, the current is 10 A and the power is 500 W. The total power consumed when 100 V is applied to the two coils connected in parallel will be: _____	**02**	CO-2
Q, 2 (c)	A series R-L-C Circuit is to be designed for a Quality factor Q=10 and resonant frequency = 25kHz. The value of resistance, inductance and capacitance for the maximum power dissipation of 1000 Watt at 10 A would be _____	**03**	CO-2
Q, 2 (d)	A three phase 420V, 50Hz, AC supply is fed to a three-phase balanced delta connected 15kW, 0.6 lagging PF load. The per phase inductance would be: _____	**02**	CO-2
Q, 2 (e)	A DC-DC buck converter operating in CCM and with ideal switches at 80kHz, is designed to regulate an output voltage = 24V at 60 Watt, with the applied DC input varying from 36V to 48V, for the minimum inductive current ripple allowed to be 30 % of the output current, the minimum inductance required would be approximately: _____	**02**	CO-4
Q. 2 (f)	A Li-FePO4 Battery pack is required to be designed for a High-Mast Street light load of 320 Watt at nominal voltage of 12V for a back-up period of 8 Hrs. The minimum Ampere-hour rating needed for such application would be_____	**02**	CO-5
Q. 2 (g)	The C-rating of the cells in a Battery pack rated for 1.8kWh battery pack at nominal voltage of 12V for a rated battery current of 30A would be----------	**02**	CO-5
Q 3 (a)	The Switch in the given Circuit was Open for a long time and is Closed at t=0. Determine current i(t) at t=0.5 seconds.	**05**	CO-1

			
Q 3 (b)	i)Derive the emf equation of a transformer. ii)Compare ideal and practical transformer by drawing phasor diagram without connecting any load on secondary side. iii) Justify the significance of OC and SC test on transformer?	**01** **02** **02**	CO-3
Q 3 (c)	Which DC Motor do you see being used for below scenarios? Provide detailed explanation to justify your answer. (1) You are at Hindmata Junction. There is water logging due to heavy rains. There are Centrifugal Pumps deployed to drain the water. (2) You are at Parel Yard of Western Railways and see repair work going on for Electric Locomotive engine. OR Draw and explain Torque Slip and Torque Speed characteristics of Induction Motor.	**05**	CO-3
Q. 4 (a)	An inductor L is connected in series with a capacitor C and the combination is connected to a variable frequency alternating voltage supply. A resistor R is connected in parallel with a capacitor C. The current through the inductor at a specific frequency f_0 is found to be in phase with the source voltage. (i) Find an expression for the net complex impedance of the circuit which appears across the voltage source at the frequency f_0 (ii) Derive an expression for the resonant frequency of the equivalent series R-L-C circuit in rad/seconds. (iii) Find the value of the frequency f_0 , if R=10 Ohm, L=1mH and C=100 µF	**05**	CO-2

Q. 4 (b)	A three phase 10 hp (7.46kWatt), 0.86 pf lagging induction motor load is connected across a 420 V, 50Hz three phase balanced AC Supply. If the Induction motor stator winding is star connected, (i) Find the per phase resistance and inductance of the stator winding assuming rated loading conditions (ii) If a balanced Delta connected three phase Capacitor Bank is connected across the motor terminals to compensate the input power factor near unity at rated load, calculate the per phase capacitance of the Capacitor Bank.	**05**	CO-2
Q. 4 (c)	A DC-DC buck-boost converter operating in CCM and with ideal switches at 80kHz is designed to regulate an output voltage = 50V at 500Watt, with the applied DC input varying from 35V to 100V, for the minimum inductive current ripple allowed to be 30% of the output current and the percentage output voltage ripple to be 2%, Find: (i) Average value of the switch current and diode current (ii) The minimum Inductance and Capacitor values. (iii) The duty cycle range of this converter over the input voltage range **OR** A DC-DC buck converter operating in CCM and with ideal switches at 100kHz is designed to regulate an output voltage = 24V at 360 Watt, with the applied DC input varying from 36V to 72V, for the minimum inductive current ripple allowed to be 20% of the output current and the percentage output voltage ripple to be 2%, Find: (i) Average value of the switch current and diode current (ii) The minimum Inductance and Capacitor values. (iii) The duty cycle range of this converter over the input voltage range	**05**	CO-4