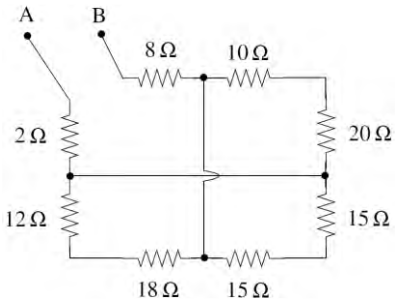
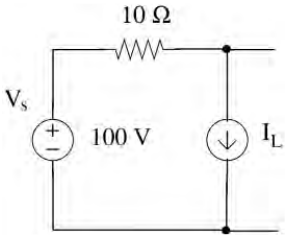
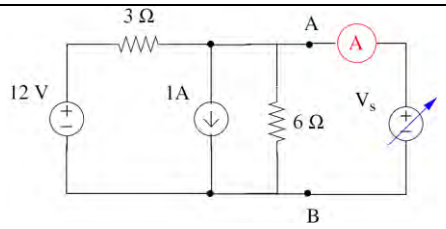
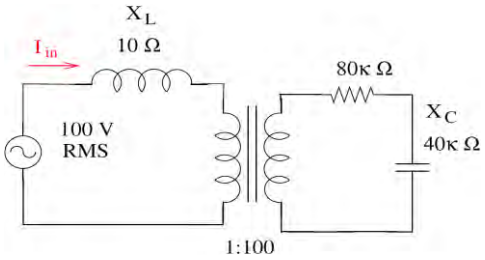
Bharatiya Vidya Bhavan's
Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous College Affiliated to University of Mumbai)

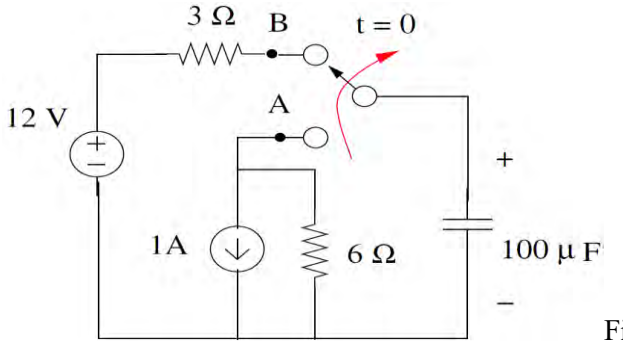
End Semester Examination
Aug-Sep 2021

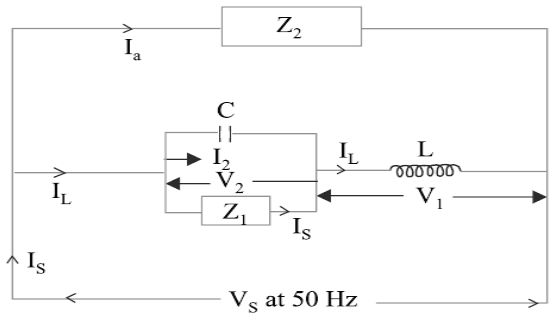
Max. Marks: 60 **Duration: 2 Hrs**
Class: F.Y. **Semester: II**
Course Code: ET101 **Branch: Computer Engineering & Information Technology Engineering**
Name of the Course: Basic Electrical Engineering

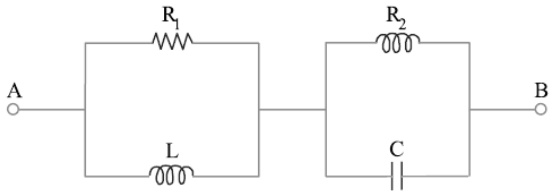
Instructions:
(1) All questions are compulsory, with appropriate internal choice in some questions
(2) Q.1 and Q. 2: Only Answers with appropriate units are desired, no steps are expected.
(3) Q. 3 and Q.4: Subjective questions with detailed step-wise solution is expected
(4) Draw neat diagrams wherever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

Question No.		Max. Marks	CO
Q 1 (a)	The resistance measured across terminals A-B in Fig.1 would be------  Fig.1	**02**	CO-1
Q 1 (b)	In the circuit shown in Fig.2, V_s=100V is a constant voltage source and I_L is a constant current load. Then the value of I_L that maximizes the power absorbed by the constant current load shall be -----  Fig. 2	**02**	CO-1
Q 1 (c)	In fig.3, the value of the variable voltage source Vs, so adjusted that the ammeter reads 0 Value, would be --------	**02**	CO-1

	 Fig.3		
Q 1 (d)	Assuming ideal transformer, the RMS value of current I_{in} in Fig.4 would be----------  Fig.4	**03**	CO-3
Q 1 (e)	The primary and secondary side number of turns of a single-phase 230/115, 1kVA, 50Hz, Transformer with a Maximum flux density as 1.5 Tesla and mean core area of 100 cm^2 would be approximately ----------N_1=------ N_2=---------	**03**	CO-3
Q 1 (f)	A 20 pole, 3-Phase alternator driven at a speed of 1600 RPM supplies electrical power to a 3-Phase 6-pole Induction Motor (IM). The actual mechanical speed of the IM at a Full load slip of 2.5% shall be-------- (Hint: The 3-Phase alternator is a synchronous Machine, the rotor speed and speed of air-gap rotating flux shall be same)	**03**	CO-3
Q 2 (a)	At the instant t=0, the instantaneous value of a 50 Hz sinusoidal current is 5A and increases in magnitude further. Its rms value is 10A. the value of current at t=0.01 sec. would be_____A.	**02**	CO-2
Q.2 (b)	A choke coil is connected to a 240V ac supply. When the frequency of the supply is 50Hz, an ammeter connected in series with the choke reads 60A. On increasing the frequency of the ac supply to 100 Hz, the same ammeter reads 40A. The resistance and inductance of the coil is _____and _____respectively.	**02**	CO-2
Q, 2 (c)	A series RLC circuit is resonating at 10 kHz frequency. It has a bandwidth of 1 kHz and draws 15.3 W from a 200V generator operating at the resonance frequency of the circuit, the value of circuit parameters are: R=_____, L=_____and C=_____	**03**	CO-2

Q, 2 (d)	A star connected alternator supplies a delta connected load. The impedance of the load branch is (8 + j6) ohm/phase. The line voltage is 230V. The reactive power of the load is_____	**02**	CO-2
Q, 2 (e)	A DC-DC buck converter operating in CCM and with ideal switches at 100kHZ, is designed to regulate an output voltage of 12V at 24 Watt, with the applied DC input varying from 24V to 48V, for the minimum inductive current ripple allowed to be 30% of the output current and the percentage output voltage ripple to be 4%. The minimum required inductance would be_____	**02**	CO-4
Q. 2 (f)	An alkaline cell is discharged at a steady current of 4 A for 12 hours, the average terminals voltage being 1.5 V. To restore it to its original state of charge, a steady current of 3 A for 20 hours is required, the average terminal voltage being 1.86V. The Watt-Hour efficiency in this case would be_____%	**02**	CO-5
Q. 2 (g)	C-rating of the cells in a battery pack rated for 1.5 kWh battery pack at nominal voltage of 15 V for a rated battery current of 10A is _____	**02**	CO-5
Q 3 (a)	Refer Fig.5, the SPDT switch is at position A for a long time and the capacitor voltage reaches to steady state. At time t=0, the switch is thrown to position B. (a) Derive the generalized expression for the instantaneous value of the capacitor voltage for t > 0, assuming the initial voltage be V_{c0} (b) Find out the instance (time) measured from t=0, at which the Capacitor Voltage becomes Zero (0) Volts.  Fig. 5	**05** **(02)** **(03)**	CO-1

Q 3 (b)	A single-phase, 200-kVA transformer has an efficiency of 98 % at full-load. If the maximum efficiency occurs at three-quarter of full-load. Calculate the efficiency at, (a) half of full-load current, (b) full load current. Assuming the load power factor to be 0.8 lagging at all the loading conditions.	**05**	CO-3
Q 3 (c)	Two magnetically coupled coils A and B having 1200 and 800 turns, respectively, lie near each other, so that 60% of the flux produced in one links with other. It is found that 5A current flowing in coil A produces a flux of 0.25mWb, while the same current flowing in coil B produces a flux of 0.15mWb. Determine, self-inductance of coils A and B, Mutual Inductance and Coefficient of Coupling between the coils. **OR** (a) A DC Motor runs at 900 RPM from a 460V DC supply. Calculate the approximate speed when the same machine connected across a 200V DC Supply, assuming the new flux to be 0.7 times the original flux. (b) Draw Torque Vs Armature current and Speed Vs Armature Current Characteristics of DC Shunt, series and compound motor shown simultaneously on the respective plots	**05** **03** **02**	CO-3
Q. 4 (a)	For the given circuit, L=0.159 H, C=0.3183 mf, I_2=5∠60°A, V_1= 250∠90°V. Calculate (Refer Fig. 6) (i) impedance Z_1 with its components (ii) Source voltage in the form of $V_m \cos(\omega t + \phi)$ considering I_L as reference. (iii) Impedance Z2 with its components so that source p.f. is unity, without adding to the circuit power loss. (iv) Draw phasor diagram.  Fig. 6	**01** **01** **02** **01**	CO-2

	OR What is the meaning of resonance in a circuit of Fig. 7 ? For the given circuit, Calculate (i) Total impedance Z_{AB} (ii) Expression for Resonant frequency in Hz in terms of R_1, R_2, L and C (iii) Value of resonant frequency if R_1=R_2=1 ohm, L= 1mH, C=100μF  Fig. 7	**01** **01** **02** **01**	
Q. 4 (b)	A 3 phase, 220 V, 50 Hz, 11.2 kW induction motor has a full load efficiency of 88% and draws a line current of 38 A under full load, when connected to a 3 phase, 220V supply. Find the reading on two wattmeters connected in the circuit to measure the input to the motor. Determine also power factor at which the motor is operating.	**05**	CO-2
Q. 4 (c)	Explain working of DC-DC Boost converter with the help of following design example: A DC-DC boost converter operating in CCM and with ideal switches at 50kHz, is designed to regulate an output voltage of 400V at 400Watt, with the applied DC input varying from 200V to 300V, for the minimum inductive current ripple allowed to be 20% of the output current and the percentage output voltage ripple to be 2%, Calculate the minimum value of inductor, minimum value of capacitor and the percentage duty cycle range.	**05**	CO-4

$----------PAPER ENDS HERE----------$