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ABV- Indian Institute of Information Technology & Management, Gwalior

Semester-I

Major Examination

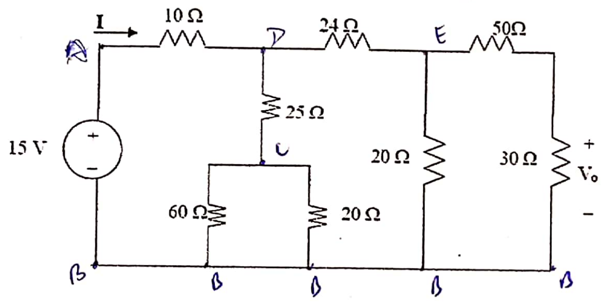
Course Title: Fundamentals of Electrical and Electronics Engineering (EE101)

MM: 50 | **Duration: 3:00 Hrs**

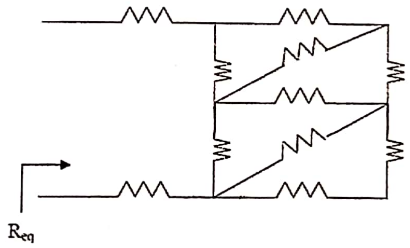
Note:

1. All parts of a question should be answered consecutively.
2. All the questions are compulsory.

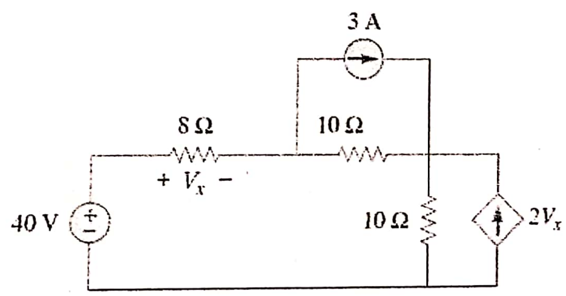
Q1. (a) Define Kirchoff's laws. Find I and v_0 in the following circuit.



(b) Derive the expression for transformation from a delta network to Y network and hence find the equivalent resistance of the following circuit where all resistors are of equal value of 1Ω.



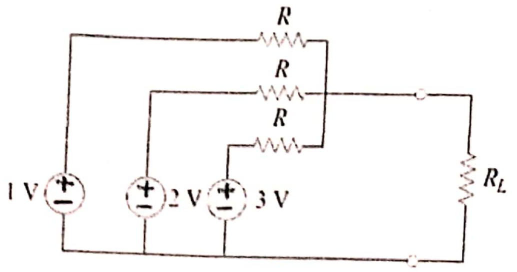
(c) Using source transformation, find the voltage v_x in the following circuit.



$V_x = \frac{20}{47}$.

(d) Define maximum power transfer theorem and hence derive the condition for maximum power transfer across the load resistance of a given circuit.

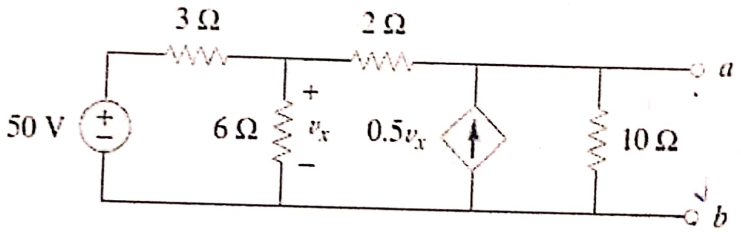
(e) For the circuit shown in figure below, determine the value of R such that the maximum power delivered to the load is 3 mW.



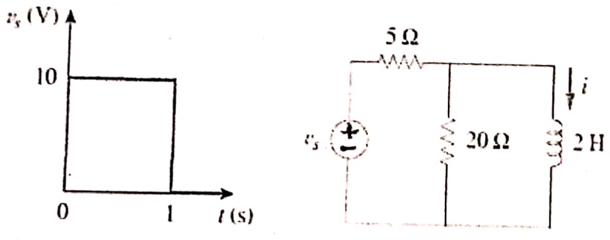
[2+3+2+3+3]

Q.2. (a) Define Norton's theorem and hence prove the same.

(b) Obtain the Thevenin and Norton equivalent circuits at terminals a-b for the circuit shown below

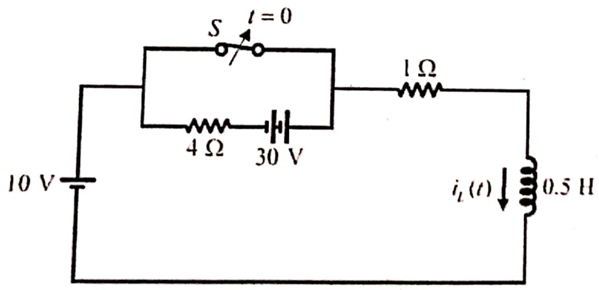


(c) If the input pulse in following figure (a) is applied to the circuit in figure (b), determine the response i(t).



(a) (b)

(d) In the circuit, switch 'S' is in the closed position for a very long time. If the switch is opened at time t =0, then find $i_L(t)$ in Amperes for t≥0.

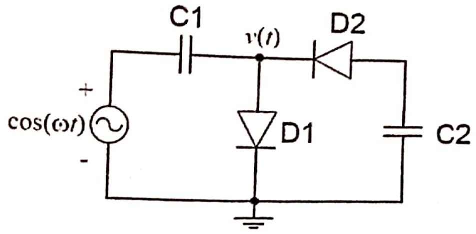


[4+3+2.5+2.5]

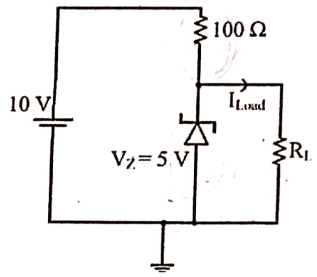
3. (a) What is Hall effect? Briefly explain the significance of the same. Also derive the relationship of hall coefficient with mobility.

(b) Briefly explain Zener and Avalanche breakdown highlighting the impact of temperature on the I-V characteristics curve. With a circuit diagram explain how Zener diode can be used as a voltage regulator.

(c) The diodes and capacitors in the circuit shown are ideal. Find the voltage v(t) across the diode D1? Also plot the input and output voltage waveform.



(d) In the circuit shown below, the knee current of the ideal Zener diode is 10 mA. To maintain 5 V across R_L, find the minimum value of R_L in Ω and the minimum power rating of the Zener diode in mW.



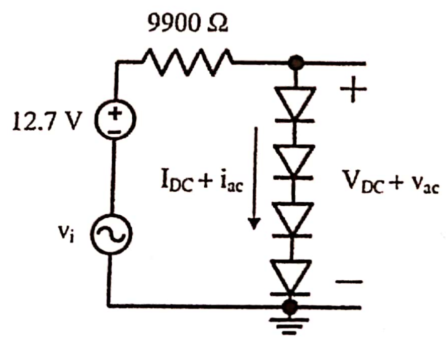
[4+3+3+3]

4. (a) With a neat diagram briefly explain the distribution of charge, electric field intensity, potential barrier across an open circuit p-n junction. Hence explain the use of same as a rectifier.

(b) What is the significance of piecewise linear model of a diode. Draw piecewise linear equivalent circuit of a diode.

(c) A silicon PN junction is forward biased with a constant current at room temperature. When the temperature is increased by 10°C, what would be the reduction in forward bias voltage across the PN junction?

(d) In the circuit shown below, assume that the voltage drop across a forward biased diode is 0.7 V. The thermal voltage $V_t = \frac{KT}{q} = 25\ mv$. The small signal input $v_i = v_p \cos(\omega t)$ where $v_p = 100mv$. Then find the bias current I_{DC} through the diodes and ac output voltage.



[4+2+2+4]