ABV- Indian Institute of Information Technology & Management, Gwalior
Semester-I

Major Examination

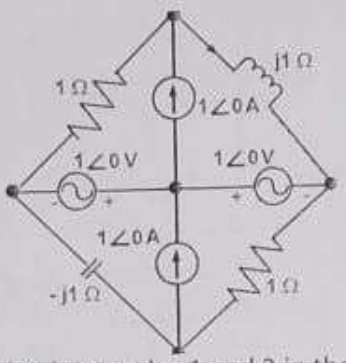
Course Title: Fundamentals of Electrical and Electronics Engineering (EE101)

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

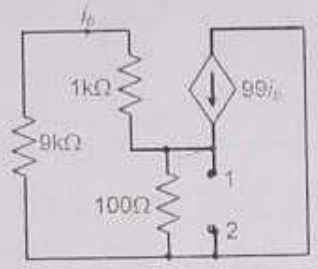
Note:

1. All parts of a question should be answered consecutively.
2. All the questions are compulsory.
3. Students may use normal scientific calculators

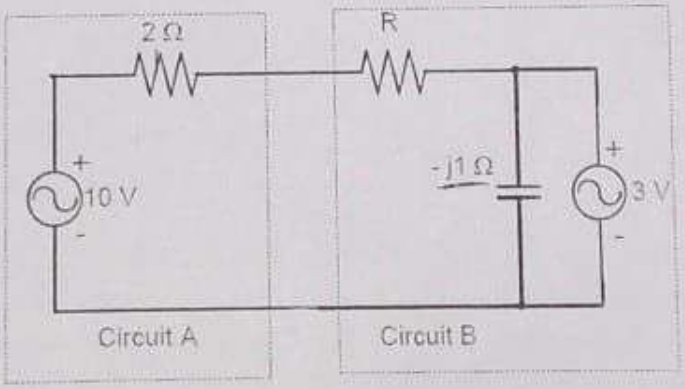
Q1. (a) In the circuit shown below, find the current through the inductor.



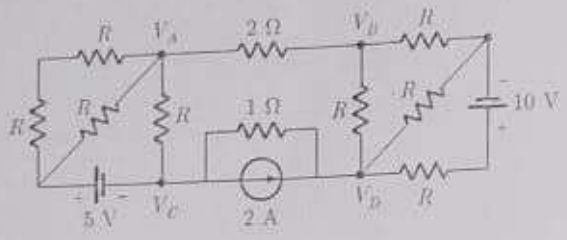
(b) Calculate the impedance looking into nodes 1 and 2 in the given circuit.



(c) Consider the circuit shown below. Find the value of R for which maximum power is transferred from circuit A to circuit B. Assume both the voltage sources are in phase.



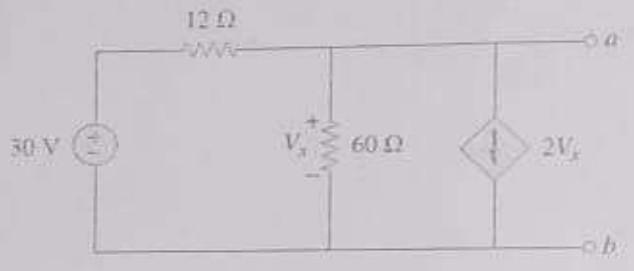
(d) For the circuit shown in the figure below, find the value of $V_C - V_D$ if $V_A - V_B = 6V$.



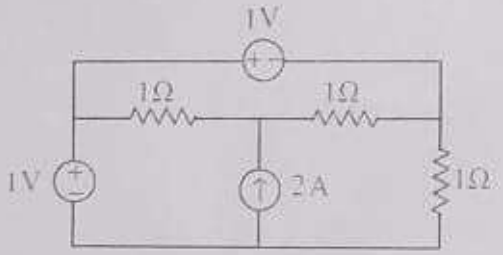
[3+3+4+3]

Q.2. (a) With a circuit diagram define and explain Thevenin's and Norton's theorem.

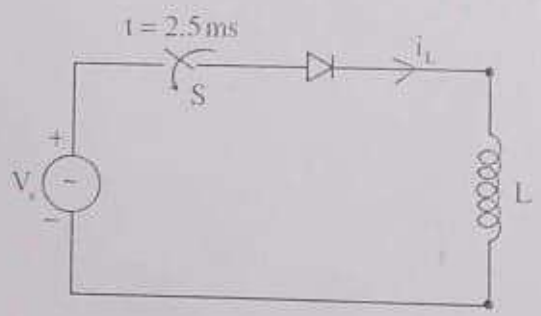
(b) Obtain the Thevenin and Norton equivalent circuits at terminals a-b for the circuit shown below.



(c) In the following circuit find the power delivered by the current source.



(d) A diode circuit feeds an ideal inductor as shown in the figure. Given $v_s = 100 \sin \omega t$ V, where $\omega = 100\pi$ rad / s, and L = 31.83 mH. The initial value of inductor current is zero. Switch S is closed at t = 2.5 ms. Then find the peak value of inductor current i_L (in A) in the first cycle.



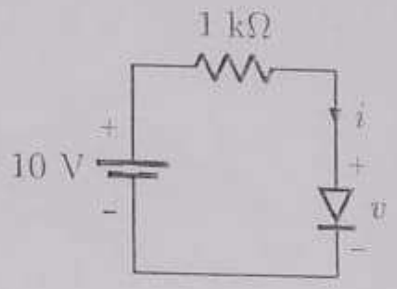
[4+3+2+3]

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

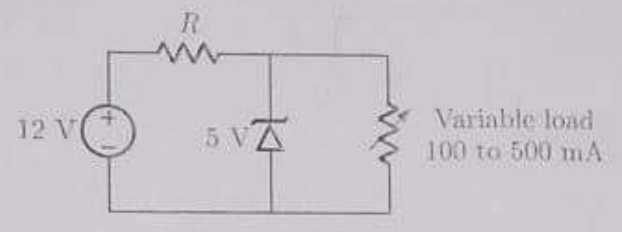
(b) Briefly explain Zener and Avalanche breakdown highlighting the impact of temperature on the I-V characteristics curve. With a circuit diagram explain how Zener diode can be used as a voltage regulator.

(c) Find the current in the following circuit where the i -v characteristics of the diode is given by below equation

$$i = \begin{cases} \frac{v-0.7}{500}\ A, & v \geq 0.7V \\ 0\ A, & v < 0.7V \end{cases}$$



(d) In the voltage regulator shown in the figure, the load current can vary from 100 mA to 500 mA. Assuming that the Zener diode is ideal (i.e., the Zener knee current is negligibly small, and Zener resistance is zero in the breakdown region), find the value of R.



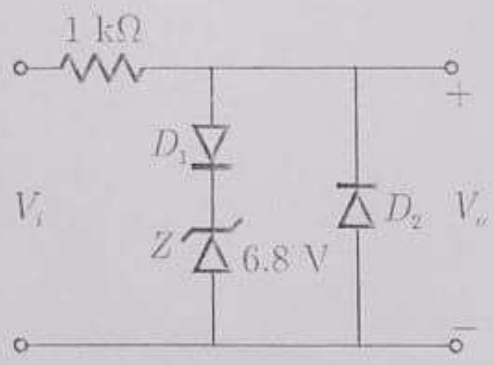
[4+3+3+3]

Q.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) Explian different types of junction capacitance. Further also explain varactor diode with its equivalent circuit model.

(c) An n –type silicon bar 0.1 cm long and 100 μm^2 cross-sectional area has a majority carrier concentration of $5X10^{20}$ /m^2 and the carrier mobility is 0.13 m^2/V-s at 300 K. If the charge of an electron is $1.5X10^{-19}$ coulomb, then find the resistance of the bar?

(d) In the following limiter circuit, an input voltage $v_i = 10 \sin 100\pi t$ is applied. Assume that the diode drop is 0.7 V when it is forward biased. The Zener breakdown voltage is 6.8 V. Find the maximum and minimum values of the output voltage.



[4+2+3+3]