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Total No. of Pages : 03

Total No. of Questions : 09

M.Sc. (Physics) (2015 to 2017) (Sem.-1)
SEMICONDUCTORS AND ELECTRONIC DEVICES
Subject Code : MPH-104
Paper ID : [A2713]

Time : 3 Hrs.

Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. Attempt FIVE questions in ALL including the compulsory question No-9.

- Q1. a) Explain the origin of capacitance in PN junction diode. Derive expression for when diode is forward biased. (12)
- b) Draw suitable circuit diagram showing FET as a switch and also describe it's working. (8)
- Q2. a) Based on CMOS techniques, trace circuit diagrams for two inputs NAND as well as for NOR gate and also describe the truth table of each. (12)
- b) Explain the construction and working of a tunnel diode. Also explain why such diode is used for high frequency applications. (8)
- Q3. a) State and explain Norton's theorem. Find Norton's equivalent circuit of following circuit where $R_1=5\text{ ohm}$, $R_2=4\text{ ohm}$ and $R_3=9\text{ ohm}$. Take R_3 as external load resistance.
- b) What is 'Bistable Circuit'? Describe circuit diagram and working of 'Bistable Circuit' you have studied. (8)

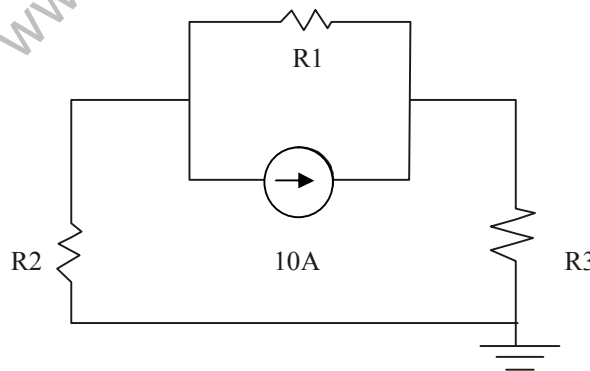


Figure - 1

- Q4. a) In following circuit how many nodes are there? Use nodal analysis calculate the voltage at each node. Given that $R_1=10\ \Omega$, $R_2=4\ \Omega$ and $R_3=2\ \Omega$. (12)
- b) Explain the terms with examples (i) DC operating points and (ii) small signal analysis (8)

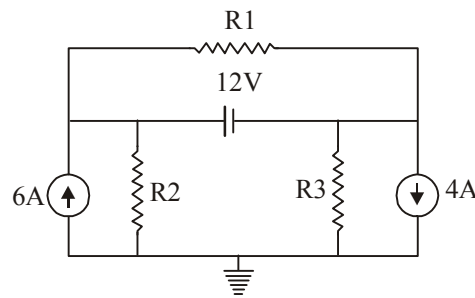


Figure - 2

- Q5. a) What are inverting op-amp and non-inverting op-amp? Derive expressions for voltage gain of each such op-amp. (12)
- b) What is logarithmic amplifier? Derive expression for output of such amplifier based on op- amp. (8)
- Q6. a) Trace a well labeled circuit diagram of Wein-Bridge oscillator based on op-amp. Describe its working and derive expression for the frequency of oscillations. (12)
- b) Based on op-amp, design and explain the summing amplifier that can form a sum of four different input voltages. (8)
- Q7. a) State the need of digital to analog converter. Describe principle, construction and working of a R-2R ladder type digital to analog converter. (12)
- b) State the salient features of a good quality digital to analog converter. Also calculate the resolution in volts of a R-2R ladder type 9 bit digital to analog converter if full scale output is +5 volt. (8)
- Q8. a) Based on negative edge triggered JK-FFs describe the construction and working of two bit up- down counter. Also trace the output pulses along with clock pulse for such counter. (12)
- b) Write detailed note on fundamentals of IC design. (8)

Q9. Answer briefly :

- a) What is Fermi level? State its importance.
- b) Why direct band gap semiconductors are preferred over indirect band gap semi - conductors?
- c) What is non-linear resistor? Name any two electronic devices that possess this property.
- d) State the 'Jump Rule' connected with 'Relaxation Oscillators'.
- e) How a voltage source is converted into a current source?
- f) Explain why oscillators are generally self-starter.
- g) Why are NAND and NOR gates called universal gates? Explain with examples.
- h) Explain the race around condition. (8×2.5=20)