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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 Rl=5 ohm, R2=4 ohm and R3=9 ohm. Take R3 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 Rl=10 ohm, R2=4 ohm and R3=2 ohm. (12)

b) Explain the terms with examples (i) DC operating points and (ii) small signal analysis (8)
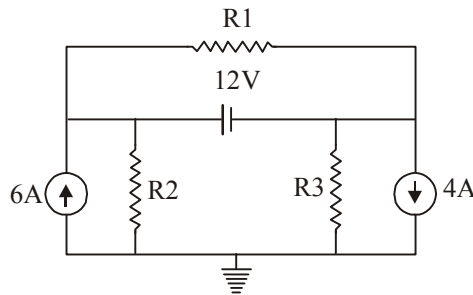

Figure - 2

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)