

**M.Sc. Physics
First Semester
Electronics
(MPH - 104)**

Duration: 3Hrs.

Full Marks: 70

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins.

Marks: 50

**Answer any four from Question no. 2 to 8
Question no. 1 is compulsory.**

1. (a) Write different applications of OPAMP. Explain how OPAMP can be used assuming amplifier and as inverting amplifier. 5
(b) Write the differences between BJT and FET. Explain with suitable diagram operation of Depletion Type MOSFETs. 5

2. (a) Explain Fermi level in a semiconductor having impurities showing the effect of doping concentration and temperature. 5
(b) Show that Fermi level in a intrinsic semiconductor is given by $E_f = \frac{E_c + E_v}{2}$.
Write down the expression for mass-action law. 5

3. (a) A half wave rectifier is connected to a $10:1$ transformer operating at the $250V - 50 Hz$ power line. It is used to drive a $20 ohms$ load ($R_L = 20 ohm$) 5
 - i) Sketch the circuit
 - ii) Sketch the output wave form

Find the following:

 - iii) V_{dc} and V_{ac} across the load
 - iv) The diode peak inverse voltage.

- (b) A diode is connected in series with a load resistance of 160Ω across a dc supply voltage of $10V$. Draw a dc load line and determine the voltage drop across the diode and diode current. 5

4. (a) Write in detail action of a J-K flip flop with logic diagram and truth table. 5
- (b) What are the different types of registers? Design a 3-bit ripple counter and describe its action with web diagram. 5
5. (a) Define modulation. Explain the process of amplitude modulation. 5
- (b) Write short note on: 5
- i) Schottky diode ii) Tunnel diode
6. (a) Design a AND gate using NAND gate with logic expression. Write the logic expression and draw the logic expression of X-OR and X-NOR gate. 2+3
- (b) Describe action of an RS flip flop with truth table and block diagram. 5
7. (a) Define MOD of counter. Differentiate between Asynchronous Counter and Synchronous Counter. 2+3
- (b) Design a MOD 9 counter with suitable block diagram and truth table. 5
8. (a) Define current density for a cross section A of a conductor with length L . Find the expression for mobility and current density in semiconductor. 5
- (b) What are the different configurations of BJT? Explain BJT for CE configuration. 5

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Marks – 20

(PART A - Objective Type)

1. Current density is given by:

- a) $J = (n\mu_n + p\mu_p)q\varepsilon$ b) $J = (p\mu_n + n\mu_p)q\varepsilon$
c) $J = (n\mu_n + p\mu_p)q$ d) $J = (\mu_n + \mu_p)q\varepsilon$.

2. Mobility $\left(\frac{m^2}{V-s}\right)$ of *electrons* and *holes* for Silicon at room temperature is

- a) (0.14,0.05) b) (0.05,0.14) c) (0.39,0.19) d) (0.19,0.39)

3. Mass action law for intrinsic material is given by

- a) $np = n_i^2$ b) $np = n^2$ c) $np = p_i^2$ d) $np = p^2$

4. _____ gate is known as universal gate

- a) AND b) OR c) NOT d) NAND

5. Which of the following is advantage of digital device?

- a) Large size b) Noise free c) Complex circuitry d) Costly

6. Maximum addressing capacity of 8085 microprocessor is

- a) 8KB b) 16KB c) 32KB d) 64KB

7. Which of the following instruction will copy content of Accumulator?

- a) *MOV B,A* b) *MOV A,C* c) *MVI A,20H* d) *HLT*

8. In a JFET, if $V_{GS} = 0$, V_{DS} increases to

- a) positive value b) negative value
c) remains same d) none of the above

9. For N-channel JFET, current flows from

- a) source to drain b) drain to source
c) drain to gate d) gate to drain

10. Maximum drain current I_{DS} for JFET is defined for

a) $V_{GS} = 0; V_{DS} > |V_P|$

b) $V_{GS} = 0; V_{DS} < |V_P|$

c) $V_{GS} = 0; V_{DS} = |V_P|$

d) none of the above.

11. Drain current for JFET is defined by

a) $I_D = I_{DSS} \left(1 - \frac{V_{GS}}{V_P}\right)^2$

b) $I_D = I_{DSS} \left(1 - \frac{V_P}{V_{GS}}\right)^2$

c) $I_D = I_{DSS} \left(1 + \frac{V_{GS}}{V_P}\right)^2$

d) $I_D = I_{DSS} \left(1 + \frac{V_P}{V_{GS}}\right)^2$

12. For enhancement type MOSFETs

a) $V_{GS} = 0$

b) $V_{GS} > 0$

c) $V_{GS} < 0$

d) none of the above

13. At room temperature, the current in an intrinsic semiconductor is due to

a) holes

b) electrons

c) ions

d) holes and electrons

14. Donor impurity atom in a semiconductor result in new

a) wide energy band

b) narrow energy band

c) discrete energy level just below conduction level

d) discrete energy level just above conduction level

15. Current flow in semiconductor depends on the phenomenon of

a) drift

b) diffusion

c) recombination

d) all of the above

16. Negative resistance effect is observed in

a) TUNNEL

b) BJT

c) FET

d) MOSFET

17. Which of the following statements is true?

a) Silicon either doped with phosphorous only or boron only is p-type semiconductor

b) Silicon either doped with phosphorous only or boron only is n-type semiconductor

c) Silicon either doped with phosphorous is p-type semiconductor

d) Silicon either doped with boron only is p-type semiconductor

18. A tunnel diode is

- a) High resistivity p-n junction diode
- c) An amplifying device

- b) A slow switching device
- d) A very heavily doped p-n junction

19. For an ideal OPAMP input impedance is

- a) zero
- b) infinity
- c) positive
- d) negative

20. For CB configuration of BJT, α is defined as:

- a) $\frac{I_c}{I_E}$
- b) $\frac{I_E}{I_C}$
- c) $\frac{I_B}{I_E}$
- d) $\frac{I_E}{I_B}$
