

M.Sc. PHYSICS  
FIRST SEMESTER  
ELECTRONICS  
MSP-104

(Use separate answer scripts for Objective & Descriptive)

Duration: 3 hrs.

Full Marks: 70

( PART-A: Objective )

Time: 20 min

Marks: 20

Choose the correct answer from the following:

1x20=20

- The drain-source voltage in FET at which the drain current becomes nearly constant is called:
  - Barrier voltage
  - Breakdown voltage
  - Pick-off voltage
  - Pinch-off voltage
- The alpha ( $\alpha$ ) and beta ( $\beta$ ) of a transistor are related to each other as:
  - $\alpha = \frac{\beta}{\beta+1}$
  - $\beta = \frac{\alpha}{1+\alpha}$
  - $\beta = \frac{1+\alpha}{\alpha}$
  - $\alpha = \frac{1+\beta}{\beta}$
- The output of EX-OR gate with A and B as inputs will be:
  - $AB + \overline{AB}$
  - $(A+B)(\overline{A+B})$
  - $(A+B)(\overline{AB})$
  - $\overline{A+B} + AB$
- The 'race round' condition in a J-K Flip flop occurs when:
  - J=0, K=0
  - J=0, K=1
  - J=1, K=0
  - J=1, K=1
- The gain of the first order low-pass filter:
  - Increases at the rate of 20 dB/decade
  - Increases at the rate of 40 dB/decade
  - Decreases at the rate of 20 dB/decade
  - Decreases at the rate of 40 dB/decade
- When the positive voltage on the gate of a p-channel JFET is increased, its drain current:
  - Increases
  - Decreases
  - Remains same
  - None of the above
- The Boolean expression  $y = AB + (A+B)(\overline{A+B})$  can be simplified as:
  - $y = A$
  - $y = \overline{A}$
  - $y = B$
  - $y = \overline{B}$
- A counter circuit is usually constructed of:
  - A number of latches connected in cascade form.
  - A number of NAND gates connected in cascade form.
  - A number of Flip flops connected in cascade form.
  - None of the mentioned.
- Zener voltage  $V_z$  is the voltage across the:
  - $R_z$
  - $V_z$
  - $R_z$
  - None of these

10. The type of total current produced during the reverse-biasing condition is:
  - a. Conventional current
  - b. Drift current
  - c. Diffusion current
  - d. All of the above
11. The intersection of load-line on the characteristic curve can easily be determined if one simply employs the fact that anywhere on the horizontal axis:
  - a.  $I_D = 0$
  - b.  $V_D > 0$
  - c.  $I_D > 0$
  - d.  $V_D = 0$
12. The lower the Q-point of operation, the ac resistance will be:
  - a. Equal
  - b. Lower
  - c. Higher
  - d. None of the above
13. An operational amplifier is basically a..... that provides a stabilized voltage gain.
  - a. Multistage
  - b. Low gain
  - c. Indirectly-coupled
  - d. None of the above
14. The point at which both input supplies are connected is called:
  - a. Earth
  - b. Analog common
  - c. Common
  - d. None of these
15. What is the power in each sideband when the carrier power is 1 KW and the modulating index is 0.3?
  - a. 22.5 W
  - b. 90 W
  - c. 300 W
  - d. 1 KW
16. As the modulation level is increased, the carrier power:
  - a. Is increased
  - b. Remains same
  - c. Is decreased
  - d. None of the above
17. A carrier is made to vary between 160 V and 40 V by a signal. What is the modulating factor?
  - a. 0.3
  - b. 0.6
  - c. 0.5
  - d. 0.4
18. For a frequency deviation of 100 KHz, calculate the carrier swing of the FM signal.
  - a. 2000 KHz
  - b. 100 KHz
  - c. 150 KHz
  - d. 200 KHz
19. An interface between free space and transmission line that converts V/I waves to E/H waves and vice-versa is called:
  - a. Transmitter
  - b. Receiver
  - c. Antenna
  - d. Switch
20. A graph which shows the distribution of field strength or power strength of EM wave at all points which are at equal distance from antenna is called:
  - a. Radiation pattern
  - b. Radiation resistance
  - c. Directivity
  - d. Gain

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**( PART-B :Descriptive )**

Time: 2 hrs. 40min.

Marks: 50

[ Answer question no.1 & any four (4) from the rest ]

1. a. Discuss about inverting OPAMP and find the expression for the output voltage. 5+3+2=10  
 b. Write the characteristics of a Voltage follower.  
 c. What is CMRR?
2. a. What is Signal to Noise ratio and noise figure in an electronic circuit? 3+2+5=10  
 b. The voltage from a transducer has a steady value of 0.95 V with a fluctuating component of 0.35 V rms. If the noise figure of the transducer is 1.3, what is the Signal to Noise ratio in the measured quantity?  
 c. With the help of a labeled diagram explain the frequency response of a low-pass filter circuit.
3. a. Draw the circuit diagram and derive the expression for voltage gain of a common drain Source-Follower JFET amplifier. 5+3+2=10  
 b. For an N-channel JFET,  $I_{DSS} = 8.7 \text{ mA}$ ,  $V_P = -3 \text{ V}$ ,  $V_{GS} = -1 \text{ V}$ . Find the values of  $I_D$ ,  $g_{m0}$  and  $g_m$ .  
 c. For a transistor,  $I_B = 100 \mu\text{A}$ ,  $\alpha_{dc} = 0.98$  and  $I_{CO} = 5 \mu\text{A}$ . Find the values of  $I_C$  and  $I_E$ .
4. a. Given the Boolean function  $F = (A + \bar{B})(CD + E)$ . Obtain AND-OR implementation and NAND implementation. 2+3+5=10  
 b. Draw the truth table and explain the working of an S-R flip flop.  
 c. Explain the operation of a 4 bit asynchronous counter.
5. a. What is a diode equivalent circuit? How can diode be replaced with equivalent model? Discuss the models with suitable figures. 4+3+3=10  
 b. Calculate the forward current  $I_F$  for Silicon diode with dynamic resistance  $r_d = 0.75 \Omega$  used in the following circuit (fig.1).  
 c. For the circuit shown in fig. 2, find the:  
 (i) output voltage and (ii) current through the Zener.

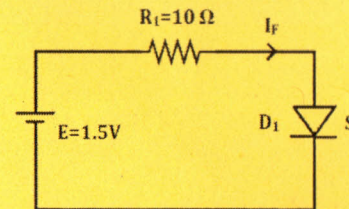


fig. 1

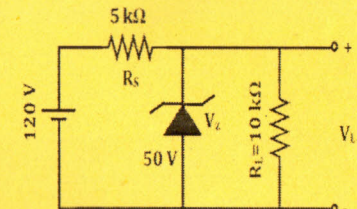


fig. 2

6. a. The total power content of an AM wave is 2.64 KW at a modulation factor of 80%. Determine the power content of (i) carrier and (ii) each sideband. 3+3+4=10
- b. An audio signal given by  $30 \sin(2\pi \times 2500t)$  is used for modulating a carrier wave given by the equation  $60 \sin(2\pi \times 200,000t)$ . Find- (i) percent modulation; (ii) frequency spectrum of the modulated wave.
- c. When a broadcast AM transmitter is 50% modulated, its transmitted antenna current is 12 A. What will be the total current when the modulation depth is increased to 0.9?
7. a. Write down basic terms used to measure antenna performance. 5+5=10  
 Explain radiation pattern of antenna with plot diagram.
- b. Explain two element antenna arrays. Draw plot diagram for  $\alpha = \pi$
- $$d = \frac{\lambda}{2}$$
8. a. An FM transmission has a frequency deviation of 18.75 KHz. Calculate percent modulation if it is broadcasted- 3+3+4=10  
 (i) in the 88-108 MHz band; (ii) as a portion of a TV broadcast
- b. Find the carrier and modulating frequencies, the modulation index and maximum deviation of FM wave represented by the voltage equation  $v=20 \sin(2 \times 10^6 t + 5 \sin 2500t)$ .
- c. A FM signal has a resting frequency of 120 MHz and the lowest frequency of 119.94 MHz when modulated by an audio signal of 6 KHz. Determine-  
 (i) Frequency deviation; (ii) Carrier swing; (iii) Modulation index;  
 (iv) Percent modulation; and (v) Highest frequency.

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