REV-01
BSP/08/13

2023/06

SET A

B.Sc. PHYSICS
FOURTH SEMESTER
ANALOG SYSTEMS & APPLICATIONS
BSP – 403

[USE OMR FOR OBJECTIVE PART]

Duration: 3 hrs. **Full Marks: 70**

(Objective)

Time: 30 min. **Marks: 20**

Choose the correct answer from the following: ***1X20=20***

1. In the depletion layer of a *pn* junction there is shortage of_____
   a. acceptor ions
   b. holes and electrons
   c. donor ions
   d. None of the mentioned

2. With forward bias to a *pn* junction, the width of depletion layer_____
   a. decreases
   b. increases
   c. remains same
   d. None of the mentioned

3. The most commonly used semiconductor is _____
   a. germanium
   b. silicon
   c. carbon
   d. sulphur

4. In an intrinsic semiconductor, the number of free electrons_____
   a. equals the number of holes
   b. is greater than the number of holes
   c. is less than the number of holes
   d. None of the mentioned

5. In ideal diode model diode in reverse bias is considered as a _____
   a. Resistor
   b. Perfect conductor
   c. Perfect insulator
   d. Capacitor

6. A simple diode rectifier has 'ripples' in the output wave which makes it unsuitable as a DC source. To overcome this one can use
   a. A capacitor in series with a the load resistance
   b. A capacitor in parallel to the load resistance
   c. Both of the mentioned situations will work
   d. None of the mentioned situations will work

7. Efficiency of half wave rectifier is _____
   a. 50%
   b. 81.2%
   c. 40.6%
   d. 45.3%

8. Which of the following are true about a zener diode?
   1) it allows current flow in reverse direction also
   2) it's used as a shunt regulator
   3) it operates in forward bias condition
   a. 3 only
   b. 1 and 2
   c. 2 and 3
   d. 2 only

9. The depletion layer of tunnel diode is very small because_____
   a. its abrupt and has high dopants
   b. uses positive conductance property
   c. its used for high frequency ranges
   d. tunneling effect

10. Tunnel diodes are made up of_____
   a. Germanium and silicon materials
   b. AlGaAs
   c. AlGaInP
   d. ZnTe

11. The operating point of a transistor is also called_____
   a. cut-off point
   b. quiescent point
   c. saturation point
   d. None

12. In a transistor_____
   a. $I_C = I_E + I_B$
   b. $I_B = I_C + I_E$
   c. $I_E = I_C - I_B$
   d. $I_E = I_C + I_B$

13. The emitter of a transistor is _____doped
   a. lightly
   b. heavily
   c. moderately
   d. None

14. At the base-emitter junction of a transistor, one finds_____
   a. reverse bias
   b. wide depletion layer
   c. low resistance
   d. high resistance

15. In a transistor, I_C=100 mA and I_E=100.5 mA. The value of β is _____
   a. 100
   b. 50
   c. 1
   d. 200

16. If the power level of an amplifier reduces to half, the db gain will fall by_____
   a. 0.5 db
   b. 2 db
   c. 10 db
   d. 3 db

17. A *Class A* power amplifier uses _____
   a. Two transistors
   b. Three transistors
   c. One transistor
   d. Four transistors

18. When negative voltage feedback is applied to an amplifier, its bandwidth_____
   a. Is increased
   b. Is decreased
   c. Remains same
   d. Insufficient data

19. In and LC circuit, when the capacitor energy is maximum, the inductor energy is_____
   a. Minimum
   b. Maximum
   c. Half-way between maximum and minimum
   d. None of the mentioned

20. The input stage of an Op-Amp is usually a_____
   a. Differential amplifier
   b. Class B push-pull amplifier
   c. CE amplifier
   d. Swamped amplifier

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Descriptive

Time : 2 hrs. 30 mins. **Marks : 50**

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

1. a. What do you understand by multistage transistor amplifier? Mention its needs. **2+6+2 =10**
   b. Explain the following terms:
   (i) Frequency response (ii) Decibel gain (iii) Bandwidth
   c. A three stage amplifier has a first stage voltage gain of 100, second stage voltage of 200 and third stage voltage gain of 400. Find the total voltage gain in db.

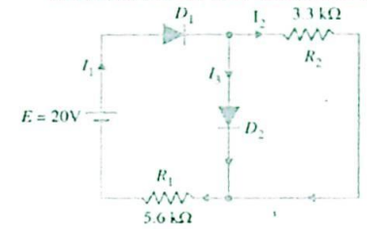
2. a. What do you understand by feedback? Why negative feedback is applied in high gain amplifiers? **3+7=10**
   b. Discuss the principles of positive and negative feedback in amplifiers with neat diagram. Derive the expression for gain in each case.

3. a. Define CMRR. What is the importance of CMRR? **2+2+6 =10**
   b. A differential amplifier has an output of 1V with a differential input of 10mV and an output of 5mV with a common-mode input of 10mV. Find the CMRR in db.
   c. Derive the expression for voltage gain of an inverting and non-inverting amplifier.

4. a. Discuss the operation of a summing amplifier. **5+5=10**
   b. Explain the operation of tank circuit with neat diagrams.

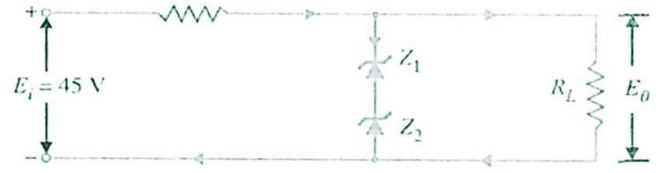
5. a. An ac voltage of 20V is connected in series with a Silicon diode and load resistance of 500Ω. If the forward resistance of the diode is 10Ω, find: (i) peak current through the diode, (ii) peak output voltage. What will be these values if the diode is assumed to be ideal? **5+5=10**

b. Determine the currents I_1, I_2 and I_3 for the network shown below. Assume the diodes to be made of Silicon and forward resistance of the diode is zero.



a. A full wave bridge rectifier uses two diodes, the internal resistance of each diode may be assumed constant at 20Ω. The transformer r.m.s secondary voltage from centre tap to each end of secondary is 50V and load resistance is 980Ω. Find (i) the mean load current (ii) the r.m.s. value of load current. **5+5=10**

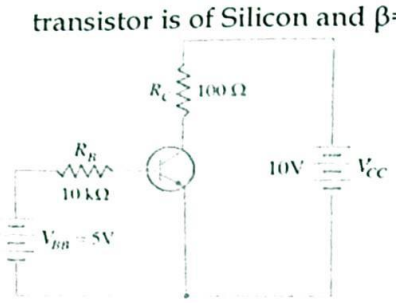
b. The circuit shown below uses two zener diodes each rated 15 V, 200 mA. Find the regulated output voltage and the value of series resistance R.



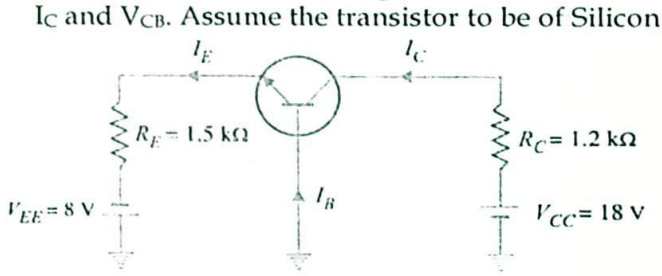
a. With the help of a circuit diagram, explain the dc load line analysis of a common emitter transistor. **7+3=10**

b. Explain the Q-point of a transistor.

8. a. Determine V_{CB} in the transistor circuit shown below. The transistor is of Silicon and β=150. **5+5=10**



b. For the common base configuration shown below, determine I_C and V_{CB}. Assume the transistor to be of Silicon.



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