1231

B.Sc. (Hons.) / III · A

PHYSICS – PAPER – XXI

(Electronic Devices : Physics and Applications)

Time : 3 Hours · **Maximum Marks : 38**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **five** questions in all.

Question No. **1** is compulsory.

Attempt **one** question from each Section.

Use of calculator (non-scientific) is allowed.

1. Attempt any **four** parts : 4 × 1 ½

   (a) Discuss any two advantages and one disadvantages of FM over AM.

(b) A light emitting diode (LED) formed from an alloy semiconductor has E_g = 1.9 eV. Find the wavelength of the emitted light when the diode is forward biased. ($h = 6.63 \times 10^{-34}$ J-sec)

(c) Draw the waveform that will be shown in a CRO across a – b
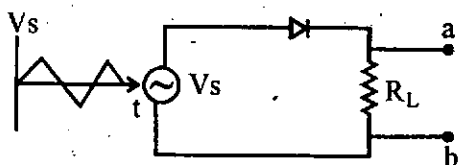
(d) What is Noise ? Mention any two sources of Noise in a transistor.

(e) How does the junction capacitance of reversed biased p-n diode varies with applied voltage ?

(f) Draw the h-parameter equivalent circuit for a transistor in CE mode.

SECTION – A

2. (a) State and prove Maximum power transfer theorem. **5**

   (b) Find the Thevenin equivalent circuit for the given network between A and B. **3**
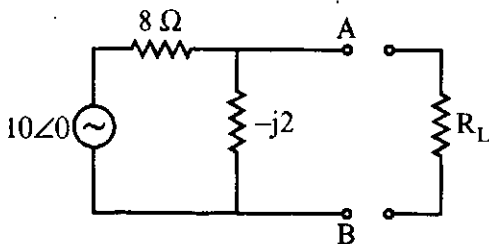
3. (a) For an unbiased p-n junction diode, sketch the variation of space charge, electric field and potential as a function of distance across the junction. Obtain the expression for potential barrier and widths of depletion layer. **5**

   (b) The reverse saturation current of a p-n junction diode is 5 μA at 300 K. Find the voltage to be applied to obtain a forward current of 50 μA. ($k_B = 1.38 \times 10^{-23}$ J/K). **3**
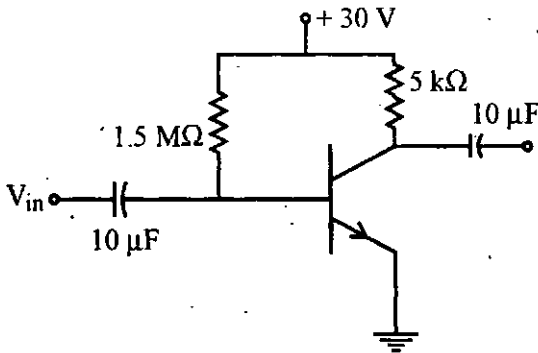
SECTION – B

4. (a) Explain working of a diode detector circuit and sketch the output waveform. Obtain a relation between time constant RC of the circuit and modulating frequency. **6**

   (b) A carrier wave of 100 watts is subjected to 50% amplitude modulation. Determine

   (i) power of the modulated wave.

   (ii) power contained in each of the side bands. **2**

5. (a) Obtain the expression for total collector current flowing through CE configuration of a transistor taking into account leakage current. **2**

   (b) With the help of a necessary circuit diagram, draw and discuss the drain (static) characteristics of an n-channel FET. **3**

   (c) Explain how is a zener diode used in voltage regulation under both varying input and varying load conditions. **3**

SECTION – C

6. (a) Draw the circuit diagram of a two-stage R-C Coupled Amplifier. Draw the a.c. equivalent circuit at mid, low and high frequency. Calculate the voltage gain in the mid frequency region.   5

   (b) An Amplifier has a voltage gain of 100. The feedback ratio is 0.04. Calculate   3

      (i)   the voltage gain with feedback.

      (ii) the output voltage of the feedback amplifier for an input voltage 40 mV.

      (iii) the feedback factor.

7. (a) Explain the need of biasing and stabilization in an amplifier. Draw and discuss the voltage divider bias circuit. Derive an expression for its stability factor.   5

(b) Draw the load line for the following circuit, also locate the Q-point ($\beta = 100$).　　　3

SECTION – D

8. (a) Explain the operation of a Colpitt's oscillator with the help of a circuit diagram. Derive an expression for the frequency of oscillation and condition for sustained oscillation.　　　6

　　(b) A piezoelectric crystal used in a crystal oscillator is resonant at 450 kHz. For this frequency, its equivalent inductance and series resistance are 3.5 H and 9050 Ohm respectively. What is the Q value of the crystal ?　　　2

9. (a) What is a relaxation oscillator ? Draw and discuss the working of a UJT sweep generator and calculate the time period of oscillator.   6

(b) Draw the labelled circuit diagram of an astable multivibrator using BJT.   2

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