[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 5817 **J**

Unique Paper Code : 2512011203

Name of the Paper : Analog Electronics – I

Name of the Course : **B.Sc. (H) Electronics (CORE)**

Semester : II

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** question in all, out of which you have to attempt **five** questions.
3. **All** questions carry equal marks. The **first** Question is Compulsory.
4. The use of a Scientific non-programmable Calculator is allowed.

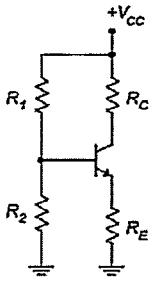
Q1 (a) What is an ideal diode? Explain its piecewise linear equivalent circuit.
(b) What are the advantages of negative feedback in amplifiers?
(c) Explain the structure of an n-channel MOSFET.
(d) Explain the working principle of a shunt capacitor filter in a power supply circuit.
(e) Define the PIV rating of a diode? Compare the PIV rating of diodes used in half wave and full wave rectifier circuits.
(f) Given that α_{dc}=0.985, determine the corresponding value of β_{dc}.

6X3

Q2 (a) Draw and explain the VI characteristics of a Zener diode. How is a Zener diode used as a voltage regulator?
(b) What are clamping circuits? Describe the various types of clamping circuits with the help of corresponding waveforms.
(c) Explain the working of a Half wave rectifier circuit and derive an expression for its ripple factor.

3X6

Q3 (a) Describe the working of a Class A power amplifier with a circuit diagram. Calculate the Efficiency . How can its efficiency be improved further.
(b) Determine the dc bias voltage V_{CE} and the current I_C for the voltage-divider configuration, when V_{cc}=22V, R_1=39 KΩ , R_2=3.9 KΩ , R_C=10 KΩ , R_E=1.5 KΩ , and β=140.



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(c) Discuss the concept of negative and positive feedback in amplifiers. Discuss one application of each. 3X6

Q4 (a) Explain working of the R-C Phase shift oscillator. Derive the expressions for the Frequency of Oscillation.

(b) Identify the active, cut off and saturation regions of a transistor in CE mode. Define the current gains ,alpha and beta and derive the relation between them.

(c) Draw circuit diagram of CE transistor amplifier circuit. Explain its operation and the impact of coupling and parasitic capacitances on the frequency response. 3X6

5 (a) Compare depletion-mode and enhancement-mode MOSFETs.

(b) Discuss the significance of the MOSFET as a switch in digital circuits. What are its advantages over BJTs?

(c) What is channel length modulation in a MOSFET? How does it affect the device's output characteristics? 3X6

6 (a) For a given n-MOSFET, threshold voltage, V_{th}=1 V, V_{DS}=5 V, K_n'=200 $\mu A/V^2$, W/L=10. When a gate to source voltage (V_{gs}) of 3V is applied, find the region of operation of n-MOSFET. Also, calculate the drain current I_{DS}.

(b) Explain the operation of a common-source MOSFET amplifier and draw its small signal equivalent model. Describe the frequency response of a MOSFET amplifier.

(c) Explain the working of a CMOS inverter circuit. How does it function as a digital logic inverter? 3X6

7 (a) Derive the voltage gain expression for a common-source MOSFET amplifier with and without source degeneration.

(b) Discuss the fundamental differences between the operation principles of MOSFETs and BJTs. Explain how these differences influence their current control mechanisms and input impedance characteristics.

(c) What causes short-channel effects in MOSFETs, and how do they impact device behaviour as transistor sizes shrink. 3x6