



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 4th Semester Examination, 2022

PHSACOR10T-PHYSICS (CC10)

Time Allotted: 2 Hours

Full Marks: 40

The figures in the margin indicate full marks.

Candidates should answer in their own words and adhere to the word limit as practicable.

All symbols are of usual significance.

Question No. 1 is compulsory and answer any *two* from the rest

1. Answer any *ten* questions from the following:

2×10 = 20

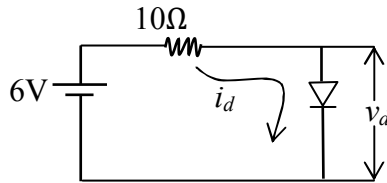
(a) Both N-P-N and P-N-P transistors contain same type of material (either p-type or n-type) at collector and emitter then why we require identifying collector and emitter?

(b) In the given circuit current through diode i_d define as

$$i_d = v_d^2 + v_d \text{ when } v_d > 0$$

$$= 0 \text{ when } v_d = 0$$

here, v_d is the voltage drop across the diode. Find the value of v_d .



(c) Why is h-parameter model circuit is not valid for high frequencies?

(d) Explain why FET is called a “field effect” transistor?

(e) A multistage amplifier employs five stages each of which has a power gain 30. What is the overall gain of the amplifier in dB?

(f) What is load line? Explain its significance.

(g) Draw the ac equivalent circuit of an ideal OPAMP.

(h) An amplifier with open loop voltage gain $A_v = 1000 \pm 100$ is available. It is necessary to have an amplifier where voltage gain varies by not more than $\pm 1\%$. Find the reverse transmission factor β of the feedback network to be used.

(i) What is Schmitt trigger? Name an application of it.

(j) State the Barkhausen criterion for sustaining oscillation in a feedback amplifier and represent it graphically.

(k) Why must a solar cell be operated at the 4th quadrant of its I-V characteristics?

(l) Explain how triangular waveforms can be produced using OP-AMPS.

(m) A Zener diode regulates at 50 V over a range of diode current 5 mA to 40 mA. The supply voltage is 200 V. Find the value of resistance R to allow voltage regulation from a load current 0 A to a Maximum value of load current I_{\max} . Find also I_{\max} .

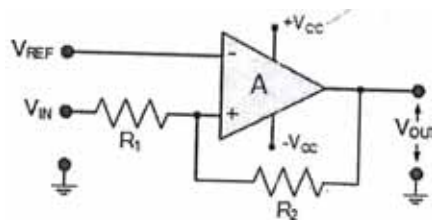
(n) Thermal noise in a CE mode circuit is much higher than that in a CB mode circuit. Explain.

2. (a) Explain why the depletion region in FET is wider near the drain and narrower near source? 3
- (b) Explain why the gain of a R-C coupled amplifier falls at low and high frequencies? 4
- (c) Determine the output voltage of an OPAMP for input voltages $v_{i1} = 150 \mu\text{V}$, $v_{i2} = 140 \mu\text{V}$. The amplifier has a differential gain $A_d = 4000$ and $\text{CMRR} = 100$. 3

3. (a) Draw the circuit diagram of a non-inverting summing amplifier and find its voltage gain. 3
- (b) A PNP transistor is used in self biasing arrangement. The circuit components are $V_{CC} = 10 \text{ V}$, $R_C = 5.2 \text{ k}\Omega$, $R_1 = 27 \text{ k}\Omega$, $R_2 = 2.7 \text{ k}\Omega$, $R_E = 0.27 \text{ k}\Omega$, $V_{BE} = 0.7 \text{ V}$ and $\beta = 49$. Find the stability factor and quiescent point. (The variables have their usual meaning) 4
- (c) Calculate the ripple percentage of a capacitor filter for a peak rectified voltage of 30 V, the value of capacitor $C = 50 \mu\text{F}$ and a load current of 50 mA. 3

4. (a) Derive the expressions for non-ideal inverting voltage gain and non-inverting $1 + \frac{1}{2} + 1 + \frac{1}{2} + 1$ voltage gain of an operational amplifier. Hence find the ideal voltage gains also. 3
- (b) Determine the feedback factor for the RC-phase-shift oscillator using BJT. 3
- (c) What is negative feedback in amplifier? Find the effect of negative feedback on distortion. 1+2

5. (a) In a Hartley oscillator the self inductances are $L_1 = 100 \text{ mH}$, $L_2 = 1 \text{ mH}$ and mutual inductance between the coils is 20 mH, Find the frequency of oscillation of the oscillator if the value of capacitance = 20 μF . 3
- (b) Find the forward resistance of a Si PN junction diode if the forward current through the diode is 5 mA at Temperature $T = 300 \text{ K}$ (η for Si = 2). 3
- (c) An operational amplifier is to be used with positive feedback to produce a non-inverting comparator circuit. If resistor, $R_1 = 10 \text{ k}\Omega$ and resistor, $R_2 = 90 \text{ k}\Omega$, what will be the values of the upper and lower switching points of the reference voltage and the width of the hysteresis if the op-amp is connected to a dual $\pm 10 \text{ V}$ power supply. 4



N.B. : Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.

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