Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

Course: Analog System and Application
Semester: IV
Program: B.Sc H (Physics) **Time: 03 hrs.**
Code: PHYS 2006 **Max. Marks: 100**

Instructions: All questions are compulsory. Internal choices are given in Q6 and Q10

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	In a fixed-bias CE circuit, for $\beta = 100$, a) I_B increases 100 times as fast as I_{CO}. b) I_B increases 101 times as fast as I_{CO}. c) I_C increases 100 times as fast as I_{CO}. d) I_C increases 101 times as fast as I_{CO}.	**4**	**CO2**
Q2	For an ideal Op-Amp, value of input impedance, output impedance, bandwidth, offset voltage and open loop voltage gain are (a)……., (b)……., (c)…….., (d)……and (e) ……..respectively.	**4**	**CO1**
Q3	In the _____ region, the _____ junction is reverse-biased and the _____ junction is forward-biased. a) Active; emitter; collector b) Active; collector; emitter c) Saturation; emitter; collector d) Cutoff; collector; emitter	**4**	**CO1**
Q4	"In an n-type semiconductor material, the free-electron concentration is _____ the density of donor atoms." a) Greater than b) Less than c) Approximately equal to d) Not related with	**4**	**CO1**
Q5	List the basic conditions to be satisfied for faithful amplification.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q6	Write short notes on any two of the following: (a) Varactor diode (b) Zener diode (c) Solar Cell (d) Light Emitting Diode	**10**	**CO1**

Q7	Draw the circuit diagram and explain the working of a RC coupled transistor amplifier. Also mention its advantages and disadvantages.	**10**	**CO2**
Q8	What is bias stabilization and why it is needed? Draw the circuit of a voltage divider bias and explain its advantages over others.	**10**	**CO2**
Q9	When negative voltage feedback is applied to an amplifier of gain 100, the overall gain falls to 50. (i) Calculate the fraction of the output voltage feedback. (ii) If this fraction is maintained, calculate the value of the amplifier gain required if the overall gain is to be 75.	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q10	With the help of circuit diagrams, graphs and expressions for output explain the working of OP-AMP as (1) Inverting amplifier, (2) Non-inverting amplifier, (3) Differentiator and (4) Integrator. OR (a) Make the circuit diagram of a Colpitt's oscillator and write the expressions of frequency and feedback fraction. What are the drawbacks of L-C based oscillators? (b) Make the circuit diagram of phase shift oscillator, write the expressions for frequency and feedback fraction, and mention its advantages and disadvantages.	**20**	**CO3**
Q11	(a)Using Avogadro's number, verify the numerical value given in following Table for the concentration of atoms in germanium (b) Find the resistivity of intrinsic germanium at 300° K .(c) If a donor-type impurity is added to the extent of 1 part in 10^8 germanium atoms, find the resistivity. (d) If germanium were a monovalent metal, find the ratio of its conductivity to that of the n-type semiconductor in part c.	**20**	**CO4**

Property	Ge	Si
Atomic number	32	14
Atomic weight	72.6	28.1
Density, g/cm³	5.32	2.33
Dielectric constant (relative)	16	12
Atoms/cm³	4.4×10^{22}	5.0×10^{22}
E_{GO}, eV, at 0°K	0.785	1.21
E_G, eV, at 300°K	0.72	1.1
n_i at 300°K, cm^{-3}	2.5×10^{13}	1.5×10^{10}
Intrinsic resistivity at 300°K, Ω-cm	45	230,000
μ_n, cm²/V-s at 300°K	3,800	1,300
μ_p, cm²/V-s at 300°K	1,800	500
D_n, cm²/s = $\mu_n V_T$	99	34
D_p, cm²/s = $\mu_p V_T$	47	13