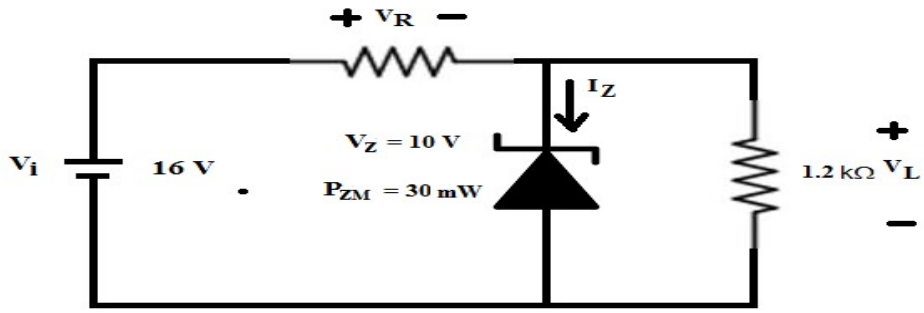
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2019

Course: Basic Electronics Engineering **Semester: II**
Program: B-Tech CSE-CCVT, BAO, MFT+MAD, G&G, BFSI+ECRA, IT Infra **Time 03 hrs.**
Course Code: PHYS1003 **Max. Marks: 100**

Instructions:
1. **Draw suitable diagrams wherever required.**
2. **Your answer should be concise and to the point.**

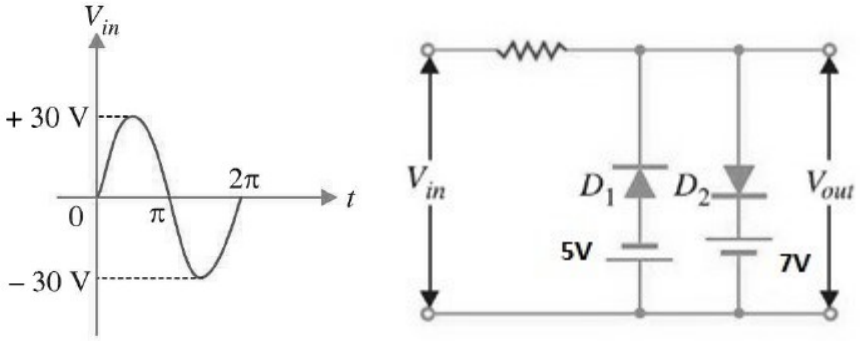
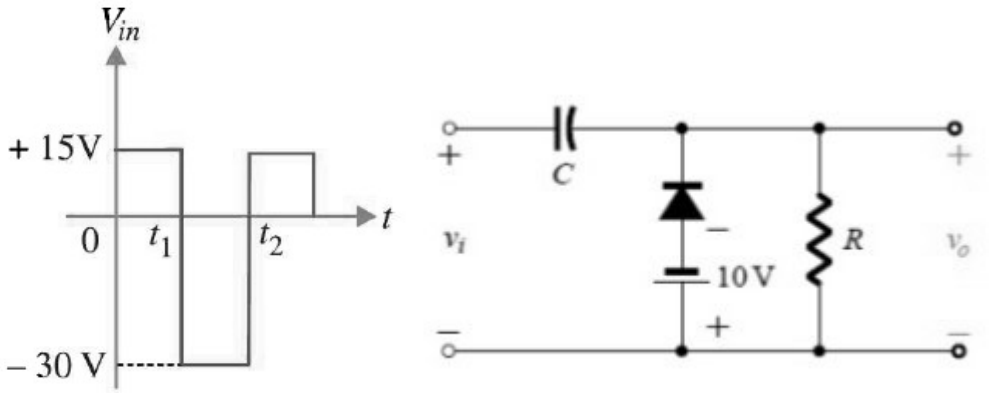
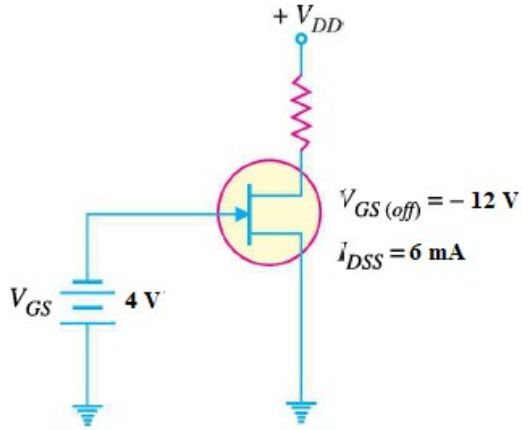
SECTION A

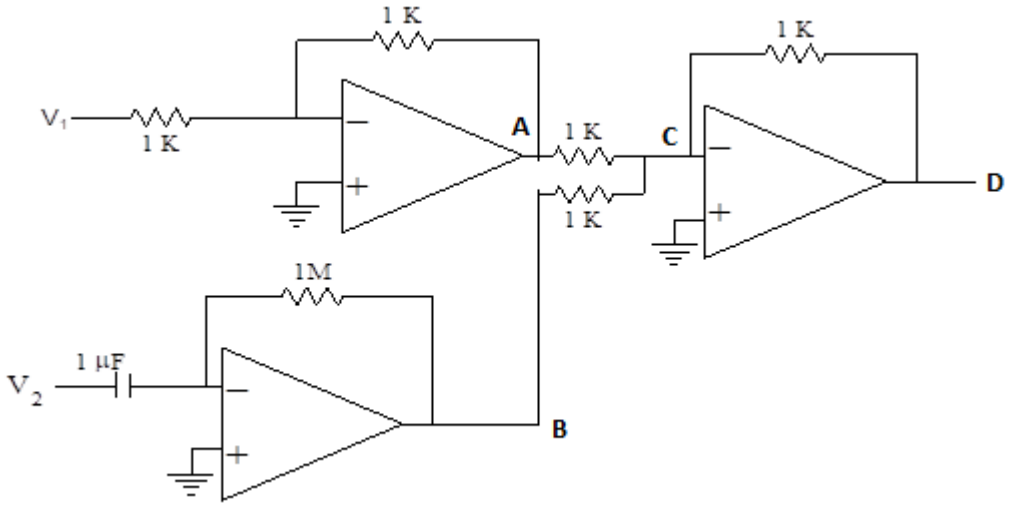
S. No.		Marks	CO
Q 1	Write the charge neutrality equation and law of mass equation for semiconductors.	**4**	**CO1**
Q 2	Determine whether zener diode is ON or OFF for the circuit given below. 	**4**	**CO1**
Q 3	Sketch the circuit for a PNP or NPN transistor in Common Base configuration. Mark I_C, I_B, I_E, V_{BE} and V_{CB} in the circuit.	**4**	**CO2**
Q 4	Differentiate between Bipolar Junction Transistor (BJT) and Junction Field Effect Transistor (JFET).	**4**	**CO2**
Q 5	Define the terms (i) CMRR (ii) Slew rate in view of Operational amplifier.	**4**	**CO3**

SECTION B

(All questions are compulsory. Question no. 9 has internal choice)

Q 6	a) A sample of Si is doped with Phosphorous to a density of $10^{21}/m^3$. What will be the conductivity of the Si sample? The electron mobility in Si is $0.18 m^2/V\text{-}s$ and hole mobility is $0.048 m^2/V\text{-}s$. b) Explain the effect of biasing on the width of depletion region.	**[5+5]**	**CO1**
Q 7	What do you mean by modulation and why it is required? Explain in brief the different types of modulation.	**10**	**CO4**
Q 8 a)	Solve the given clipper circuit to draw its output waveform assuming the diode as	**10**	**CO1**

	ideal one.  **OR** Solve the given clamper network to draw its output waveform.  		
Q 9	Discuss the construction of n-channel D-MOSFET. Determine the value of drain current for the circuit given below.  	**10**	**CO2**
	SECTION-C **(Q10 is compulsory. Attempt either Q11 or Q12)**		
Q 10	a) Draw the circuit diagram of an operational amplifier to be used as an integrator. Also find the expression for the output voltage. b) What are negative and positive feedbacks in amplifiers and derive respective	**10** **10**	**CO3** **CO3**

	expressions for their voltage gain?		
Q 11	a) Find the expression for the output voltage at points A, B, C and D in the circuit shown below.  	**10**	**CO3**
	b) Design an adder circuit using Operational amplifier to give the output $V_o = -(3V_1 + 4V_2 + 5V_3)$ where V_1, V_2 and V_3 are the inputs and $R_f = 15k\Omega$	**10**	**CO3**
Q 12	a) Design a four stage Operational amplifier circuit in which the gains of the four stages are +21, -15, +11 and -24 respectively. Use a 240 kΩ feedback resistor for all the four circuits. What output voltage will result for an input of 160µV?	**10**	**CO3**
	b) Derive the relation for the output voltage of a three input inverting adder using operational amplifier.	**10**	**CO3**

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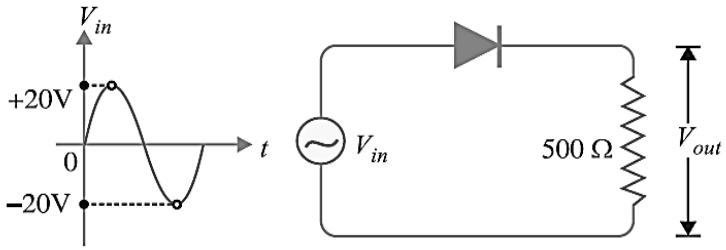
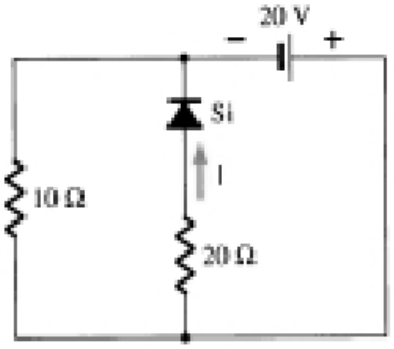
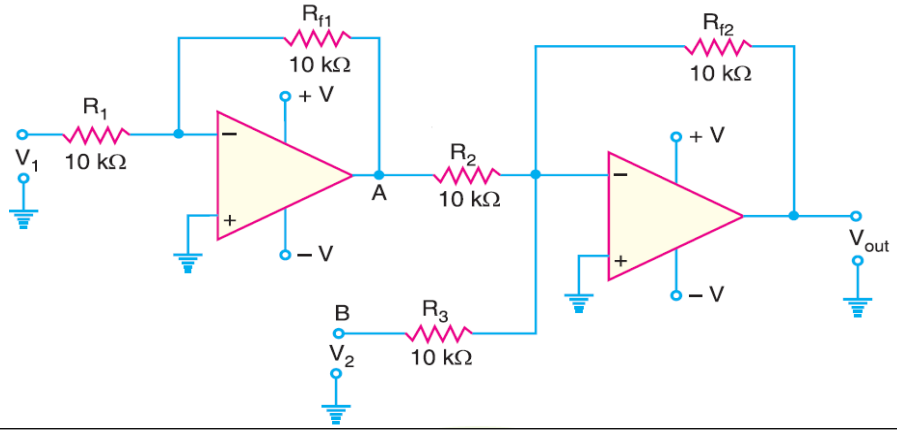
Course Code: PHYS1003 **Max. Marks: 100**

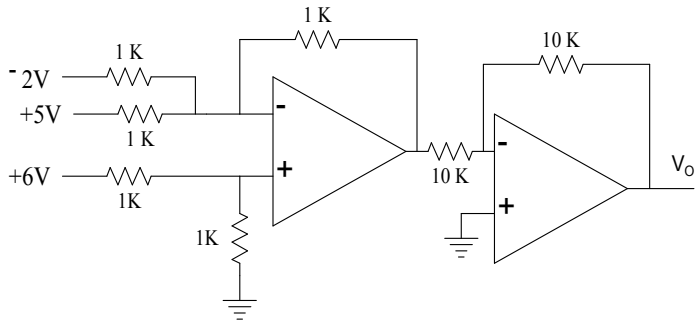
Instructions:

1. **Answers should be concise and to the point.**
2. **Assume any missing data**

SECTION A (20 marks) All question of section A are compulsory

S. No.		Marks	CO
Q 1	Plot the VI characteristics of a silicon and germanium diodes on the same scales. Clearly label the various parameters.	4	CO1
Q 2	Show that the conductivity of intrinsic germanium at 300K is 0.0232 S/cm. Given that $n_i = 2.5 \times 10^{13}$ cm^{-3}, $\mu_n = 3800$ cm^2/Volt-sec and $\mu_p = 1800$ cm^2/Volt-sec.	4	CO1
Q 3	Explain the physical structure of NPN transistor with respect to physical dimensions, doping and heat dissipation.	4	CO2
Q 4	Enumerate the principle differences between the working of a depletion type MOSFET and enhancement type MOSFET.	4	CO2
Q 5	Briefly explain the concept of virtual ground with respect to operation amplifiers.	4	CO3
	SECTION B (40 marks) All question of section B are compulsory		
Q 6	An a.c. voltage of peak value 20V and frequency 100 Hz 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 diode, and (ii) Peak output voltage (iii) Output signal frequency. Also plot the output waveform across 500Ω resistor. 	10	CO1
Q 7	(a) Explain the following terms with respect to a JFET. (i) Pinch-off Voltage (ii) $V_{GS(off)}/V_{GScut-off}$ (b) A JFET to be used as an amplifier has following parameters: $V_{GS(off)}=Vp=-25V$, $I_{DSS}=20\,mA$. Plot the transconductance curve for the	2 8	CO2

	device.		
Q 8	Draw the equivalent circuit of Si diode by using the first approximation under forward and reverse biased conditions Determine the current I for the configuration of figure given below using the first diode approximation.  	**10**	**CO1**
Q 9	Define modulation. What is the importance of modulation in communication system? Differentiate between AM and FM.	**10**	**CO4**
	SECTION C (40 marks) Question 11 has an internal choice in B part.		
Q 10	a) Derive an expression for the output of op-amp based differentiator circuit. Design the differentiator circuit to obtain the following expression: $V_{out} = -2\frac{dV_i}{dt}$ b) What are the advantages and disadvantages of negative feedback if it is employed in the amplifier circuit? c) A single stage transistor amplifier has a open loop voltage gain of 600 without feedback and 50 with feedback. Calculate feedback factor (β).	**10** **5** **5**	**CO3** **CO3**
Q 11	a) Analyze the circuit given below and obtain the expression for output voltage:  	**10**	**CO3**

	(b) Design an op-amp based circuit to obtain the following expression: $V_{out} = -(V¿¿a + 2V_b + V_c)¿$ **OR** (b) Analyze the circuit given below and calculate the value of output voltage:  	**10**	**CO3**