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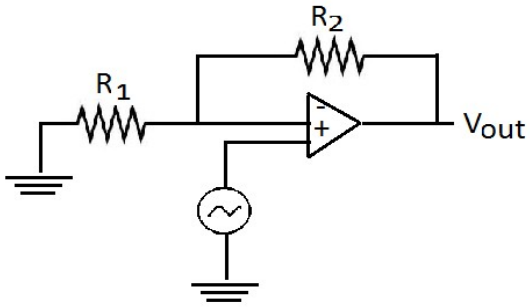
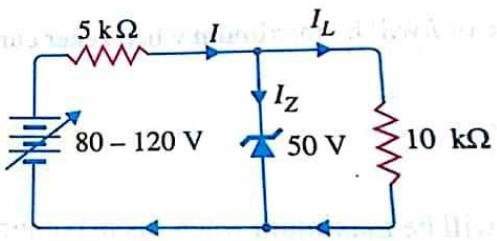
UNIVERSITY OF PETROLEUM & ENERGY STUDIES

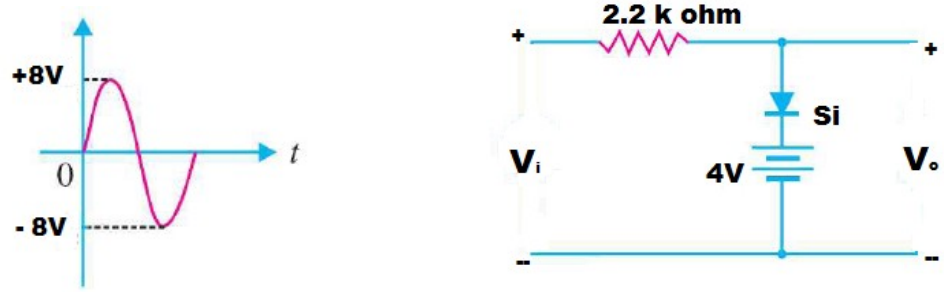
End-Term Examination – December, 2017

Program/Course : B.Tech (CIT: CCVT, GG, MFT, MC, OSS, SCF, IOT, OG, CYBER LAW, BIG DATA, DevOps) **Semester : I**
Subject: Basic Electronics Engineering **Max. Marks : 100**
Code : PHYS1003 **Duration : 3 Hrs**
No. of page/s: 02

Instructions:

1. **Draw suitable circuit diagrams wherever required to justify your answer.**
2. **Your answer should be concise and to the point.**

	Section A (All questions are compulsory)		
1.	Explain the formation of depletion region in a P-N junction diode.	**[4]**	**CO1**
2.	Draw the circuit diagram for n-p-n transistor in C-E configuration. Explain why C-B configuration is not preferred for transistor to be used as current amplifier?	**[4]**	**CO3**
3.	Define the term "Slew Rate" and "CMRR" in contest with Operational Amplifiers.	**[4]**	**CO4**
4.	Write a brief note on signal to noise ratio in context to communication system. (maximum 60 words)	**[4]**	**CO5**
5.	What do you mean by Amplitude modulation? What are its limitations?	**[4]**	**CO5**
	Section B (All questions are compulsory. Question no. 9 has internal choice)		
6.	Derive an expression for the output voltage for an Op-amp Adder in inverting mode. Calculate the output voltage from the non-inverting amplifier circuit shown in figure below for an input of 120μV. Given, R_1=2.4 kΩ and R_2 = 240 kΩ. Also calculate the current in resistance R_1. 	**[5+5]**	**CO4**
7.	Analyze the circuit shown below to determine the range of Zener current for keeping a constant voltage across the load resistance. 	**[10]**	**CO2**

8.	What is feedback process in transistor amplifiers? What are negative and positive feedbacks and derive their respective expressions for voltage gain? Explain the advantage of negative feedback used in amplifiers.	**[2+6+2]**	**CO4**
9.	What is a load line and explain its importance? In C-E configuration if V_{CC} =10 V, R_L= 8 kΩ, draw the d.c. load line. What will be the Q point if zero signal base current is 12 μA and β=40? OR Explain the construction and working of JFET. Give some differences between JFET and Bipolar Junction Transistor.	**[10]**	**CO3**
	Section C (Question 10 is compulsory. Question 11 has internal choices.)		
10.	a) A copper wire of 2 mm diameter with conductivity of 5.8 x 10^2 Siemens/m and electron mobility of 0.0032 m^2/V-s is subjected to an electric field of 2 x 10^{-2}V/m. Find (a) the charge density of free electrons, (b) the current density, (c) the current flowing in the wire, (d) the electron drift velocity. Given charge on an electron = 1.6 x 10^{-19} C.	**[10]**	**CO1**
	b) Write down the steps for determining the output waveform of unbiased positive Clampers? Analyze the circuit shown below to determine the output waveform. 	**[5+5]**	**CO2**
11. (a)	(i) What is an Op-amp Integrator? Derive an expression for the output voltage for an Op-amp Integrator. Draw the output sketch of an Integrator Op-amp circuit if the input is a square wave signal having both positive and negative halves.	**[2+5+3]**	**CO4**
	(ii) What is modulation and modulation index? Explain the need of modulation in communication system? The maximum peak to peak voltage of AM wave is 40 mV and minimum peak to peak voltage is 10 mV. Calculate the modulation factor.	**[3+4+3]**	**CO5**
	OR		
11. (b)	(i) A three stage Op-amp circuit is required to provide voltage gains of +10, -18 and -27. Design the Op-amp circuit. Use a 270 kΩ feedback resistor for all the three circuits. What output voltage will result for an input of 150μV?	**[10]**	**CO4**
	(ii) What is a radio receiver? Discuss the Amplitude Modulation superhetrodyne receiver by explaining the function of each stage with the help of a block diagram.	**[2+8]**	**CO5**

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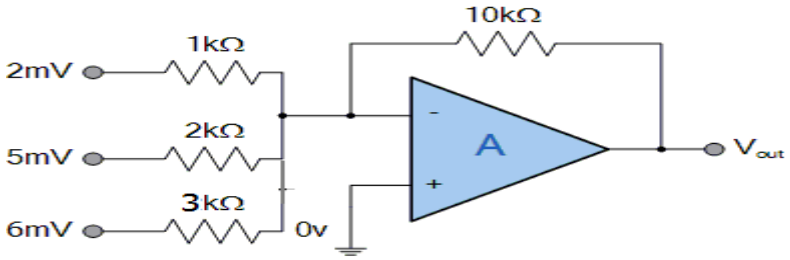
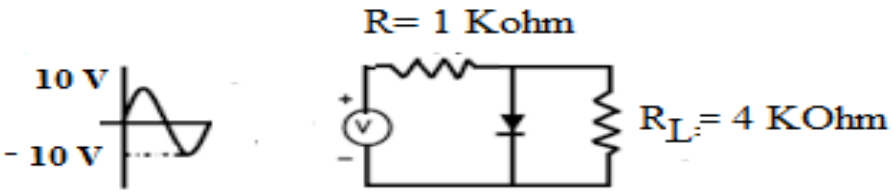
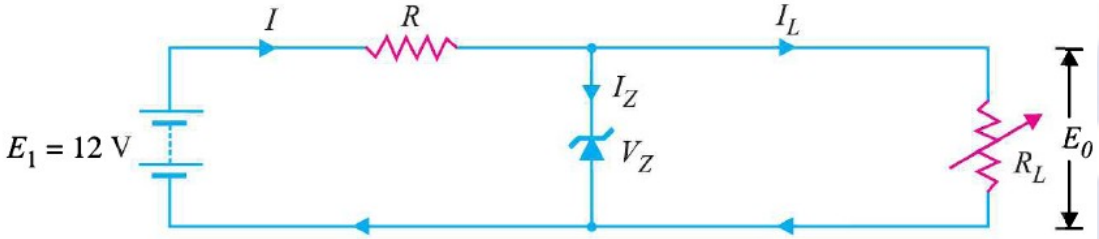
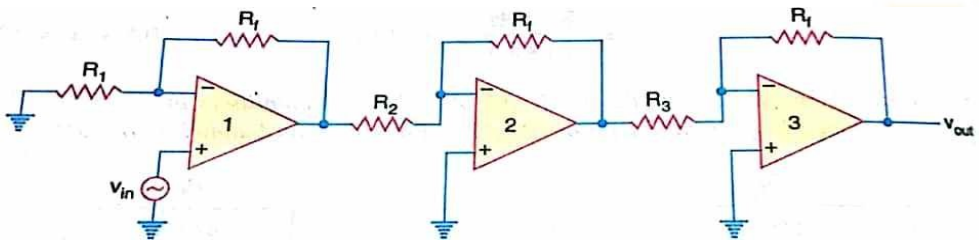
	Section A (All questions are compulsory)		
1.	What do you mean by the diode equation and explain why it is called diode equation?	**[4]**	**CO1**
2.	Draw the input and output characteristic of NPN transistor in common emitter configuration and mark the different operating region.	**[4]**	**CO3**
3.	Explain the term "Input offset voltage" and "output offset voltage" in Operational Amplifier.	**[4]**	**CO4**
4.	Give some differences between Frequency Modulation and Amplitude Modulation.	**[4]**	**CO5**
5.	Discuss the different type of Noises with respect to communication system.	**[4]**	**CO5**
	Section B (All questions are compulsory. Question no. 9 has internal choice)		
6.	Discuss the working of half and full wave center tapped rectifier with suitable circuit diagram. An input voltage of 40sinwt and frequency 50 Hz is applied to a half-wave rectifier. R_L= 200 Ω, R_F = 20 Ω, Find I_{dc}, and I_{rms}.	**[6+4]**	**CO2**
7.	Derive an expression for the output voltage of an Op-amp differentiator. Find the output voltage for the given circuit 	**[6+4]**	**CO4**
8.	How the amplifier can be classified on the basis of operating point? Which types of operational amplifier have maximum efficiency and conduction angle?	**[7+ 3]**	**CO4**
9	Define Load line and operating point. In CE configuration V_{CC} = 12 V, R_L = 6 KΩ. Draw the load line. Determine operating point Q for zero signal, if base current is 1 μA and β= 50. **OR** What are the basic differences between JFET and MOSFET? Discuss the working and	**[4+6]**	**CO3**

	construction of enhancement type MOSFET.		
	Section C (Question 10 is compulsory. Question 11 has internal choices.)		
10.(a)	A specimen of Silicon is 0.2 mm long and has a cross-section of 0.2 x 0.2 mm. One volt is applied across the bar results in a current of 8 mA. Assuming that the current is due to electrons, calculate (i) concentration of free electrons and (ii) the drift velocity. Given at 300K, μ_n = 1300 cm^2/V-s and q = 1.6 x 10^{-19} C.	**[10]**	**CO1**
10.(b)	(i) Solve the circuit to determine the value of output voltage waveform.  (ii) A 7.2 V Zener is used in the circuit shown below and the load current is to vary from 15 to 110 mA. Find the value of series resistance R to maintain a voltage of 7.2 V across the load. The input voltage is constant at 12V and the minimum Zener current is 10 mA. 	**[5 + 5]**	**CO2**
11.(a)	(i) Discuss the virtual ground concept in an ideal operational amplifier. Derive the relation for voltage gain for inverting operational amplifier. (ii) Discuss the Frequency Modulation receiver by explaining the function of each stage with the help of a suitable block diagram. Give some differences between the Frequency Modulation and Amplitude Modulation receivers.	**[4+6]** **[6+4]**	**CO4** **CO5**
	OR		
11.(b)	(i) What do you mean by Operational amplifier and write the characteristic of an Ideal operational amplifier. Find the output voltage for an input voltage of 80 µV for the given circuit The resistor values are R_f= 470kΩ , R_1 = 4.3 KΩ, R_2= 33 KΩ and R_3 = 33 KΩ 	**[5+5]**	**CO4**
	(ii) What do you understand by amplitude modulation? What are the limitations of amplitude modulation? Explain the demodulation term along with its necessity.	**[3+3+4]**	**CO5**