Question Paper Code: 41335

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2016

Third Semester

Electrical and Electronics Engineering

14UEE305 - SEMICONDUCTOR DEVICES AND CIRCUITS

(Regulation 2014)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- 1. Which of the following applies to a P-N junction diode?
 - (a) majority carriers are the holes
 - (b) minority carriers are electrons
 - (c) pentavalent and trivalent impurities are present
 - (d) all of the above
- 2. Resistivity of a semiconductor
 - (a) increases linearly (b) decreases linearly
 - (c) increases exponentially (d) decreases exponentially
- 3. The avalanche effect takes place in which of the following regions of transistor operation?

(a) saturation	(b) cutoff	(c) breakdown	(d) active
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- 4. Which of the following change is likely to occur in the Q-point when the collector current increases?
 - (a) no change(b) shifts to saturation region(c) shifts to cut-off region(d) oscillates in the active region

5.	n a N-type channel, $V_{GS} = 0$, V_{DS} is increased. Which of the following does not happen?					
	(a) depletion region	increases	(b) decrease in dra	in current		
	(c) I_D reaches a limit	ing value	(d) none of these			
6.	The amplification factor of the a common source JFET amplifier is given by					
	(a) $\mu = g_m \times (R_D R_L / R_L)$	$R_D + R_L$	(b) $\mu = -g_m \times (R_D R_L)$	$(R_D + R_L)$		
	(c) $\mu = g_m \times (R_L/R_D +$	$-R_L$)	(d) $\mu = -g_m \times (R_L/R_L)$	$R_D + R_L$)		
7.	Which of the following is a disadvantage of negative feedback?					
	(a) higher input imp	edance	(b) reduced gain			
	(c) lower output resi	stance	(d) oscillation is pr	revented		
8.	In an RC phase shift oscillator, the number of sections normally employed are					
	(a) one	(b) two	(c) three	(d) four		
9.	Cross over distortion behavior is characteristic of					
	(a) Class A output stage(c) Class AB output stage		(b) Class B output stage			
			(d) Common base output stage			
10.	10. A circuit that adds positive or negative DC voltage to an input sine wave is called					
	(a) clamper	(b) clipper	(c) diode clamp	(d) limiter		

PART - B (5 x 2 = 10 Marks)

- 11. How does LED emit colored light?
- 12. Calculate the collector current I_C and emitter current I_E for a transistor that has $\alpha = 0.98$ and $I_B = 100 \mu A$. Determine the value of β or h_{fE} of a transistor.
- 13. Differentiate between BJT and JFET.
- 14. Define Barkhausen criteria for sustained oscillations.
- 15. Why commutating capacitors are used in bistable multivibrator?

PART - C ($5 \times 16 = 80$ Marks)

16. (a) (i) Why Zener diodes are used as voltage regulators? Explain series voltage regulator with a neat diagram.(8)

- (ii) A Zener rated 8.2 V and 500 mW is used as a voltage regulator. If the DC input voltage is 12 V and the diode has the slope resistance of 1.75Ω , determine
 - (1) value of the resistance to be connected in series for safe operation
 - (2) magnitude of the diode current when a load of $2.0K\Omega$ is connected and
 - (3) percentage change in potential difference across the load when the input voltage varies by 10%.(8)

Or

- (b) (i) Explain the working principle of full wave rectifier and derive an expression of full wave rectifier circuit. (10)
 - (ii) The primary of the transformer is connected across mains of the supply whose effective value is 230V. If $R_L = 5\Omega$ and full wave rectifier diodes are ideal. Compute
 - (1) maximum load current
 - (2) average value of load current and
 - (3) the efficiency of the circuit.

Assume a turns ratio of 10 for the transformer. (6)

17. (a) Draw the circuit diagram of an NPN junction transistor CE configuration and describe the static input and output characteristics. Determine the h-parameters from its characteristics. (16)

Or

(b) Define stability factor. Derive the stability factor expression for

(i) Fixed bias circuit

(ii) Collector to base bias circuit. (16)

18. (a) Assuming that the saturation drain current I_{DS} is given by the parabolic relation $I_{DS} = I_{DS} \left(1 - \frac{V_{GS}}{V_P}\right)^2$. Prove that the transconductance g_m is given by $g_m = g_{m0} \left(1 - \frac{V_{GS}}{V_P}\right)$, where g_{m0} is the value of g_m at $V_{GS} = 0$. (16)

Or

(b) With suitable diagrams explain the working of different types of MOSFET. (16)

- 19. (a) (i) Derive the expression for R_{if} and R_{of} for current shunt feedback amplifier. (10)
 - (ii) An amplifier, with feedback has voltage gain of 100. When the gain without feedback changes by 20 % and the gain with feedback should not vary more than 2 %. If so, determine the values of open loop gain A and feedback ratio β. An amplifier, with feedback has voltage gain of 100. When the gain without feedback changes by 20 % and the gain with feedback should not vary more than 2 %. If so, determine the values of open loop gain A and feedback ratio β.

Or

- (b) Draw the circuit diagram and explain the working principle of RC phase shift oscillator. Also derive the expression for frequency of oscillation and condition for sustained oscillation. (16)
- 20. (a) Briefly discuss about the one shot multi-vibrator with neat circuit diagrams and waveforms. Derive the expression and mention its advantages and disadvantages. (16)

Or

(b) For a certain UJT sweep circuit, the resistance is 20 K while the capacitance is $0.2 \ \mu F$. The valley potential is 1.5 V when VBB = 15 V. Assuming diode cut in voltage of 0.7 V and intrinsic stand-off ratio as 0.5. Calculate the frequency of oscillations. (16)