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# CS/B.Tech(OLD)/SEM-1/EC-101/2011-122011

## **BASIC ELECTRONICS**

 $Time\ Allotted: 3\ Hours$ Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A						
( Multiple Choice Type Questions )						
1.	Cho	ose t	he correct alternatives f	for an	by $ten$ of the following: $10 \times 1 = 10$	
	i)	Hov	v many valence electron	s doe	es a silicon atom have?	
		a)	0	b)	1	
		c)	2	d)	4.	
	ii)	Silio	icon atoms combine into an orderly pattern called a			
		a)	covalent bond	b)	crystal	
		c)	semconductor	d)	valence orbit.	
	iii)	The	e merging of a free electron and a hole is called			
		a)	covalent bonding	b)	lifetime	
		c)	recombination	d)	thermal energy.	

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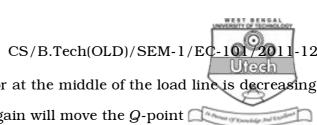
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iv)		When the reverse voltage decreases from 10 to 5 V, the			
	depletion layer				
	a)	becomes smaller	b)	becomes larger	
	c)	is unaffected	d)	breaks down.	
v)	Wha	at is the peak load volta	age i	n a full-wave rectifier if	
	the secondary voltage is 20 V rms ?				
	a)	0 V	b)	0.7 V	
	c)	14.1 V	d)	28.3 V.	
vi)	A ci	rcuit that removes po	sitive	or negative part of a	
	waveform is called a				
	a)	clamper	b)	clipper	
	c)	diode clamp	d)	limiter.	
vii)	In a	n <i>npn</i> transistor, the ma	ajorit	y carriers in the emitter	
	are				
	a)	free electrons	b)	holes	
	c)	none of these	d)	both of these.	
viii)	If th	e current gain is 100 ai	nd th	e collector current is 10	
	mA, the base current is				
	a)	10 μΑ	b)	100 μΑ	

c) 1A

d) 10A.



ix)	If a	a transistor at the middle of the load line is decreasing			
	the current gain will move the Q-point				
	a)	down	b)	up	
	c)	nowhere	d)	of the load line.	
x)	The	The output voltage of a CE amplifier is			
	a)	amplified			
	b)	inverted			
	c)	180° out of phase with	the i	input	
	d)	all of these.			
xi)	The	e transconductance increases when the drain current			
	app	approaches			
	a)	0	b)	I <sub>D(sat)</sub>	
	c)	I <sub>DSS</sub>	d)	$I_{S}$ .	
xii)	A D	-MOSFET can operate i	n the		
	a)	depletion mode only			
	b)	enhancement mode on	ıly		
	c)	depletion mode or enh	ance	ment mode	

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d) low impedance mode.

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xiii) The trigger voltage of a SCR is closest to



- a) 0 V
- b) 0.7 V
- c) 4 V
- d) break over voltage.
- xiv) The closed loop voltage gain of an inverting amplifier equals to
  - a) the ratio of the input resistance to the feedback resistance
  - b) the open loop voltage gain
  - c) the feedback resistance divided by the input resistance
  - d) the input resistance.
- xv) A four layer diode sometimes is called a
  - a) unijunction transistor
  - b) diac
  - c) pnpn diode
  - d) switch.



#### **GROUP - B**

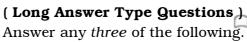
### (Short Answer Type Questions)

Answer any three of the following.

- $3 \times 5 = 15$
- 2. State the continuity equation. What are the differences between drift and diffusion?
- 3. Derive the current equation  $I_C = \beta I_B + (\beta + 1) I_{CBO}$  for the transistor.
- 4. Draw the characteristics of depletion type MOSFET and explain it.
- 5. What is input offfset current for OPAMP? What is the advantage and disadvantage of integrated circuit?
- 6. How can you measure the frequency of a signal with the hlep of CRO? What will be the shape of the Lissajous figures, when the phase difference between two signals is
  - i) 0 deg
  - ii) 90 deg
  - iii) 180 deg?
- 7. How does the barrier field form in a p-n junction ? Is it possible to measure this with the help of a voltmeter ?

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#### **GROUP - C**





- Draw the band diagram of *P-N* junction. Differentiate between 8. insulator and semiconductor. Compute the conductivity of a silicon semiconductor which is doped with acceptor impurity to a density of 10  $^{22}~$  atoms/m  $^{3}$  . Given that n  $_{i}~$  = 1·4  $\propto$  10  $^{16}$ /m  $^3$  ,  $\mu_n$  = 0·145 m  $^2$  /V-s and  $\mu_p$  = 0.05 m<sup>2</sup>/V-s. Why there is a reverse saturation current in P-N junction ? Why is bridge rectifier more preferable than centre tap fullwave rectifier? What is the difference between avalanche breakdown and zener breakdown?
- 9. Find the expression for current gain with source impedance and input resistance and output resistance for CE amplifier in terms of h-parameter. The CB h-parameters of a transistor are  $h_{ib}$  = 30 $\Omega$ ,  $h_{rb}$  = 4  $\infty$  10  $^{-4}$  ,  $h_{fb}$  = - 0.99 and  $h_{ob}$  = 0.9  $\propto 10^{-6}$  S for a suitable operating point. The amplifier is used in the CB mode with a load resistance of  $6~k\Omega$  . Calculate currrent gain and input resistance. Derive

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the expression for stability factor for collector to base bias.

- 10. Find the expression of voltage gain for common drain FET amplifier. What is the main difference between depletion type MOSFET and enhancement MOSFET ? As is changed from 1V to 1.5V keeping  $V_{\rm DS}$  constant  $I_{\rm D}$  of the FET drops from 7 mA to 5 mA. What is the transconductance of the FET ? If the ac drain resistance is 200 k $\Omega$ , find also the amplification factor of the FET. Why is FET called unipolar device ? Give the simplified model of JFET in terms of  $\mu$  and  $r_{\rm O}$ .
- 11. What is the effect of negative feedback on noise voltage, input impedance? Draw the block diagram of a negative feedback amplifier. The change in gain of an amplifier without feedback is ± 10%. Find the % change in gain when 20 dB negative feedback is introduced. If the gain of the internal amplifier is 1000, find the feedback ratio and the overall gain of the feedback amplifier. Describe the use of OP-AMP as a differentiator. What is the use of inverting amplifier?
- 12. Write short notes on any *three* of the following :  $3 \times 5$ 
  - a) Clipper circuit
  - b) Hybrid parameters of transistor and their meaning
  - c) UJT
  - d) Application of CRO.