CODING

Under Graduate Examination, May 2022
Semester **: 2 [CBCS]**
Subject Code **: EL/II/EC/03**
Subject **: Electronics [2nd Paper]**
Name of the Paper **: Semiconductor Physics**

Date of Examination **: 19-05-2022**

No. of Answer Sheet(s) Used : _____

Full Marks : 75 **Time : 3 Hours**

INSTRUCTIONS TO CANDIDATES

Please read the instructions carefully before you start writing your answers.

1. Questions should be attempted as per instructions.
2. Candidate should clearly indicate the Question Nos. and the Page No. for each sheet.
3. Please write your Roll No. and Registration No. clearly and correctly in the space provided.
4. Do not write your name or the name of your college/institution anywhere or anything else, which is not part of your answer.
5. Candidate should make sure that the answer sheets scanned should be legible.
6. The Invigilator on duty should confirm that the correct script is received, compiled and attached to the correct Cover Page.
7. Multiple Choice Answer should indicate the Question No., Sub. No., (if any) and the correct answer. For example—

   1. *Name the state capital of Mizoram.*
   (a) Lunglei
   (b) Champhai
   (c) Aizawl
   (d) Mamit

   Candidate should provide answer as **1 (c) Aizawl**

   [Candidate should avoid writing only (c)]

SECTION–A (OBJECTIVE)	
Total	
SECTION–B (SHORT ANSWER)	
Question Nos.	**Marks**
Total	
SECTION–C (DESCRIPTIVE)	
Question Nos.	**Marks**
Total	
G. Total	

CODING

To be filled in by the Candidate

Date of Examination

Semester **: 2 [CBCS]**

Subject Code
EL/II/EC/03

Subject
Electronics [2nd Paper]

Roll No. ____________________

Regn. No. ________________

No. of Additional Sheet(s) :

____

Scrutinizer's Signature *Examiner's Signature* *Invigilator's Signature*

2022

(CBCS)

(2nd Semester)

ELECTRONICS

SECOND PAPER

(Semiconductor Physics)

Full Marks : 75

Time : 3 hours

The figures in the margin indicate full marks for the questions

(SECTION : A—OBJECTIVE)

(*Marks* : 10)

Choose the correct answer from the options provided : 1×10=10

1. At absolute temperature, an intrinsic semiconductor has

(a) a few free electrons

(b) many holes

(c) many free electrons

(d) no holes or free electrons

2. The random motion of holes and free electrons due to thermal agitation is called

(a) diffusion

(b) pressure

(c) ionisation

(d) polarisation

3. If the doping level in a crystal diode is increased, the width of depletion layer

(a) remains the same

(b) is increased

(c) is decreased

(d) is first decreased and then increased

4. If the PIV rating of a diode is exceeded

(a) the diode conducts poorly

(b) the diode is destroyed

(c) the diode behaves as Zener diode

(d) the diode stops conducting

5. A PIN diode is frequently used as a

(a) peak clipper

(b) voltage regulator

(c) harmonic generator

(d) switching diode for frequencies up to GHz range

6. A *p-n* junction that radiates energy as light instead of as heat is called a

(a) LED

(b) tunnel diode

(c) varactor diode

(d) Zener diode

7. The emitter of a transistor is generally doped the heaviest because it

(a) has to dissipate maximum power

(b) has to supply the charge carriers

(c) is the first region of the transistor

(d) must possess low resistance

8. When emitter-base junction of a given transistor is forward-biased and its collector-base junction is reverse-biased, then if the base current is increased, its

(a) I_C will decrease

(b) V_{CE} will increase

(c) I_C will increase

(d) V_{CC} will increase

9. Amplifier in which the collector current flows at all times during the full cycle of the input signal is called _____ amplifier.

(a) class B

(b) class C

(c) class A

(d) class AB

10. The d.c. load line of a transistor circuit is the line

(a) on the input characteristics

(b) on the output characteristics

(c) along which Q-point shifts up and down

(d) which does not contain the Q-point

(SECTION : B—SHORT ANSWER)

(*Marks* : 15)

Answer the following questions : 3×5=15

UNIT—I

1. With the help of energy band diagram, explain conductor, semiconductor and insulator.

OR

2. Explain the salient features of Bohr's atomic model. Bismuth has atomic number of 83. How many valence electrons does it have?

UNIT—II

3. Describe the action of the following filter circuits :

(a) Capacitor filter

(b) Choke input filter

(c) Capacitor input filter

OR

4. Derive an expression for the efficiency of half-wave and full-wave rectifiers.

UNIT—III

5. Explain the use of Zener diode as meter protection.

OR

6. Write a short note on varactor diode.

UNIT—IV

7. Show the relation $\frac{\quad}{1}$, where the symbols have their usual meanings.

OR

8. What do you understand by transistor biasing? What is its need?

UNIT—V

9. Write the steps of construction of d.c. load line.

OR

10. Differentiate between voltage gain and current gain.

(SECTION : C—DESCRIPTIVE)

(*Marks* : 50)

Answer the following questions : 10×5=50

UNIT—I

1. *(a)* Discuss the effect of temperature on semiconductor. What do you understand by intrinsic and extrinsic semiconductors? 2+2=4

(b) With diagram, explain the formation of *P*-type and *N*-type semiconductors. 3+3=6

OR

2. *(a)* Draw the *V-I* characteristics of *p-n* junction diode and explain the break-down voltage and knee-voltage. 1+2+2=5

(b) Explain insulators, conductors and semiconductors in terms of energy band. 3

(c) What are the two basic rules governing the electronic distribution in an atomic shell? 2

UNIT—II

3. *(a)* With a neat sketch diagram, explain the working of *(i)* half-wave rectifier, *(ii)* full-wave centre-tapped rectifier and *(iii)* bridge rectifier. 2+2+2=6

(b) The four diodes used in a bridge rectifier circuit have forward resistances which may be considered constant at 1   and infinite reverse resistance. The alternating supply voltage is 240 V r.m.s. and load resistance is 480 . Calculate *(i)* mean load current and *(ii)* power dissipation in each diode. 4

OR

4. *(a)* What is ripple factor? Derive its values for half-wave, full-wave and bridge rectifier. 1+1+1+1=4

(b) Assume the diode is ideal. An a.c. supply of 230 V is applied to a half-wave rectifier circuit through a transformer of turn ratio 10 : 1. Find *(i)* the output d.c. voltage and *(ii)* the peak inverse voltage. 3

(c) A full-wave rectifier uses two diodes, the internal resistance of each diode may be assumed as 20 . The transformer r.m.s. secondary voltage from centre tap to each end of secondary is 50 V and load resistance is 980 . Find *(i)* mean load current and *(ii)* the r.m.s. value of load current. 3

UNIT—III

5. *(a)* Describe the construction and *V-I* characteristics of Zener diode. 2+2=4

(b) What is LED? Explain the working of LED. 1+2=3

(c) Write and explain any two applications of photodiode. 3

OR

6. *(a)* What is Zener diode? Explain how the Zener diode regulates the voltage. 1+3=4

(b) Explain the working and *V-I* characteristics of Shockley diode. 2+2=4

(c) Explain the applications, advantages and disadvantages of tunnel diode. 2

UNIT—IV

7. *(a)* Explain CB static characteristics (input, output and current transfer) of a transistor. 5

(b) With diagram, discuss the working of *p-n-p* transistor. 3

(c) A CB transistor has 0 96 and I_E 2 mA. Calculate I_C and I_B. 2

OR

8. *(a)* Explain with a diagram the leakage current in CB and CE circuits of a transistor. 6

(b) In CC configuration, show that I_E (1)I_B. 2

(c) A CE transistor has 100 and I_B 50 A. Calculate I_E and I_C. 2

UNIT—V

9. *(a)* Explain frequency response curve and bandwidth of an amplifier. What do you mean by resonant frequency? 2+2+1=5

(b) Describe the characteristics of class A amplifier. 3

(c) Explain the terms 'cut-off point' and 'saturation point'. 2

OR

10. *(a)* Explain how transistor can be used as an amplifier. What do you mean by operating point of a transistor circuit? 3+1=4

(b) Describe the characteristics of class B amplifier. 3

(c) Write short notes on d.c. and a.c. load lines. 3

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(Use of Simple Calculator allowed)