EX/PG/ETCE/T/114B/2018

M.E.T.C.E Examination 2018

(1st year,1st Semester)

PHYSICAL ELECTRONICS

Full marks 100 **Time three hours.**

Answer any three questions from the part I given below and carry equal marks.

Full Marks for Part I: 60 . Use separate answer scripts for each part.

The figures in margin indicate full marks. All the questions must be answered in one place. The answers should be precise.

PART I

Q.1 (a) Explain how drift mobility depends on material parameters ? 6

(b) What is the Hall voltage? How is it related to the drift mobility? How Hall mobility is used for material characterisation? 8

(c) What is a compensated semiconductor? Differentiate it from degenerate semiconductor with respect to the Fermi energy. 6

Q. 2 (a) Describe the different carrier generation mechanisms in semiconductors. 6

(b) Obtain the emission probabilities of electrons and holes, for Schokley-Read –Hall(SRH) recombination. 10

(c) Explain the meaning of capture cross section? 4

Q 3 (a) Obtain Einstein relation. Discuss the validity conditions for the relation. 6

(b) Derive the diffusion equation .What is the significance of the relation? 8

(c) Deduce the excess carrier decay equation. 6

Q.4 (a)Explain the concept of quasi Fermi energy. How is it significant ? 4

(b) Illustrate the concepts of minority carrier lifetime, steady and non equilibrium states. 6

(c) Describe Auger band to band recombination. Give its relevance to semiconductor optical devices. Compare it with band to band recombination for direct band semiconductor. 10

Q.5 Write short note on any **four** 5x4=20

(i) Excess carriers
(ii) Carrier recombination mechanisms,
(iii) Measurement of Hall coefficient,
(iv) Surface recombination,
(v) Drift and Diffusion,

M.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING EXAM 2018
FIRST YEAR FIRST SEMESTER

PHYSICAL ELECTRONICS

Time: 3 Hours | Use separate answer scripts for each part. | Full Marks: 100

PART II

Answer ***any TWO*** questions. Full Marks: 40

6. Establish that an electron moving through a one-dimensional lattice can have energies lying within a set of allowed bands separated by forbidden zones. 20

7.a) What do you mean by Crystal momentum? Derive expressions for carrier effective mass. 4+2+2

b) Mention the general features of conduction band of the semiconductor for which band curvature effective masses in transverse and longitudinal directions are :
(i) unequal, (ii) equal. 4+3

d) Explain how the heavy hole and light hole bands originate. 5

8.a) Briefly describe the following crystal structures with one specific example:
(i) Sphalerite, (ii) Diamond. 5+2

b) Determine how the mobility of carriers in an intrinsic semiconductor depends on its temperature. 8

c) Define Debye screening length. Explain how it influences carrier mobility. 5