

EX/PG/ETCE/T/111E/2018

M.E.T.C.E Examination 2018  
(1st year, 1st Semester)

OPTOELECTRONIC DEVICES

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

**Answer any five questions and carry equal marks**

Full Marks:100

Time: Three hours

- Q.1 (a) Discuss the Einstein Coefficients. How are they related to the LASER Operation? 8
- (b) Discuss the following 12
- (i) Threshold wavelength
  - (ii) Population of inversion in laser diode
  - (iii) Gain and response time of photodetectors
- Q. 2 (a) Explain the operation of photoconductive cell . Give the variation of cell resistance with illumination. 8
- (b) What are the limitations of p-n photodiode ? What is the concept of coherence of semiconductor LASER? 8
- (c) Give some typical medical and mechanical applications of LASER. 4
- Q.3 (a) Discuss the following parameters of photo detector and explain the Significance of
- (I) Detectivity,

(ii) Responsivity,  
(iii) Quantum Yield, 12

(b) Describe the origin of different noise mechanisms in a photodetector. 8

Q.4 (a) Describe the following devices in detail

(i) Phototransistor

(ii) PIN diode

Compare them in terms of their performance, operation and construction 14

(b) Give the sketch of mesa etched pin photodiode for (i) top illumination  
(ii) back illumination. 6

Q.5 (a) Describe the operation of Solar Cell. Also provide the equivalent circuit of Solar Cell. 10

(b) Define the following 6  
(i) Open circuit voltage and short circuit current  
(ii) Effect of temperature on solar cell performance

(c) Differentiate between photodiode and solar cell 4

Q.6 (a) Discuss the following 12  
(i) Double and single Hetero structure Lasers  
(ii) Difference between LED and LASER  
(iii) Optically coupled isolator.

(b) Discuss the characteristics of Surface emitting and edge emitting LASERS 8

Q.7 (a) Describe the construction and operation of semiconductor LED. 8

(b) Compare the energy and momentum of a photon and a phonon . 8

(c) What are the semiconducting materials required (i) green and (ii) blue lights ? List one infrared laser. 4

Q.8 Write the short note on any **four**

4x5=20

- (i) Hetero structure Laser
- (ii) APD
- (iii) Photodiode
- (iv) LED performance issue
- (v) Photovoltaics