APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Scheme for Valuation/Answer Key

Scheme of evaluation (marks in brackets) and answers of problems/key

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), MAY 2019

Course Code: EC405

Course Name: OPTICAL COMMUNICATION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) Block diagram of a light wave system (2). Mention six advantages of Optical fiber Communication system (3) (5)

b) Laser action explanation (3) figure (2) semiconductor laser diodeexplanation (3) diagram (2) (10)

2 a) Five Difference between spontaneous and stimulated emission (5)

b) Explaining modes – 2 marks
Explaining the formation of modes in single mode and multimode – 5 marks
Figures showing the mode distribution -3 marks (10)

3 a) Modified Chemical Vapor Deposition process-figure(2)
Explanation of fiber fabrication (3) (5)

b) Numerical Aperture figure (2), Explanation (3), (10)

Problem: Given, n1= 1.563, n2=1.498

The fractional refractive indices change, Δ = n1-n2 / n1=0.0416 (1 mark)

Numerical Aperture(NA)= $(n_1^2 - n_2^2)^{1/2}$ =0.446 (2 marks)

Acceptance angle=Sin^{-1}(NA)=26.48 ^{0}(2 marks

PART B

Answer any two full questions, each carries 15 marks.

4 a) Minimum Requirements of optical detectors using in optical communication (5)

b) Pin photodiode –figure (2)
Working explanation (3)
APD- figure(2)
Working Explanation (3) (10)

5 a) Responsivity- definition + Equation (2.)
Quantum Efficiency – Definition + Equation (2)
Relation between responsivity and quantum efficiency Equation (1) (5)

b) Source power Ps=0.1mW, (10)

Ps= -10dB,

Since NA= 0.25, Coupling loss= - 10 log (NA ^{2})= - 10 log (0.25 ^{2}) = 12 dB

Fiber loss =α_fx L = (6dB/km) (0.5km) = 3 dB

Connector loss=2(2dB) =4dB

Design Margin Pm= 4dB

Actual power Pout= Source Power- (Sum of losses)

Pout= 10dBm – (12dB + 3+ 4 + 4)

Pout = -33 dBm

Sence receiver sensitivity is given is -35dBm,

As Pout >Pmin, the system will perform adequately over the system operating life.

6 a) Primary photo current Ip = 0.282μA, (5)

Mean square noise current $\langle i^2_{shot} \rangle$ =1.80 x 10^{-18} A^2 or i_{shot}=1.34nA

Mean Square Dark current $\langle i^2_{DB} \rangle$ =2.56 x 10^{-20} A^2 or i_{DB} =0.16nA

Mean square Thermal noise current for the receive = $\langle i^2_T \rangle$ =323x 10 $^{-18}$ A^2 or i^2_T=18nA

b) Essential components required for establishing a point- to point link like,fiber, sources, optical detector- Explanation (5) (10)

Various losses associated with point-to-point link (2)

Loss model (2)

Equations(1)

PART C

Answer any two full questions,each carries 20 marks.

7 a) Explanation of the Fiber Bragg Grating technology(3) figure (2) two applications.(2) (7)

b) Expiation of the working of Semiconductor Optical Amplifier.(4) Figure (3) (7)

c) Comparison of the performance of different optical amplifiers. (6)

8 a) Explanation of the working principle of EDFA(4),figure (3), 6 advantages of EDFA.(3) (10)

b) OTDR-working Explanation(2),figure(2)-OTDR trace- figure(2), Explanation(2),Name of two faults that can be detected by OTDR.(2) (10)

9 a) Block diagram of optical add/drop multiplexer (2), working Explanation (3). (7)

Requirement of add/drop multiplexer in optical communication system. (2)

b) Figure (3)working of TDFA.(4) (7)

c) Li Fi technology figure(3), working (3) (6)

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