BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

Class : BTech   **Semester: VI**

BRANCH:ECE   **Session : SP/22**

SUBJECT: EC-351 Fiber Optic Communication

Time: 2 Hours   Full Marks: 50

Group A   (Tick the correct one)

Question1-10: 1 mark each

Question11-20: 2 marks each

1.   Which of the following methods does not need the soot formation process?

   A. OVPO   [1]

   B. MCVD

   C. PCVD

   D. VAD

2.   When the dopant P_2O_5 is added in silica glass fiber, it results   [1]

   A. increase in refractive index

   B.   decrease in refractive index

   C.   increase in fiber nonlinearity

   D.   increase in fiber attenuation

3.   In a Laser Diode, the spectral linewidth is determined by the following modes: [1]

   A. Longitudinal Modes

   B. Transverse Modes

   C. Lateral Modes

   D. All of these

4. The following pair is suitable for making a heterojunction that can be used for fabrication of LED or Laser diode in the shorter wavelength region: [1]

   A. Si and GaAs

   B. Ge and InP

   C. GaAs and GaAlAs

   D. InP and InGaAsP

5. In the following preamplifier that is used in optical fiber communication, both low noise and large dynamic range can be obtained: [1]

A. Low-impedance preamplifier

B. High-impedance preamplifier

C. Transimpedance preamplifier

D. All of these

6. Which of the following noises does dominate in APD photodetector? [1]

A. Quantum noise

B. Thermal noise

C. Surface leakage current noise

D. All of these

7. In EDFA architecture, optical pumping is used to excite electrons in the higher energy level. When counter directional pumping is used, the EDFA will have [1]

A. less noise performance

B. better noise performance

C. higher gain performance

D. both better gain and noise performances

8.   In optical networks, delay lines are used as buffer in   [1]

A. Circuit switching

B. Photonic packet switching

C. Optical burst switching

D. Cell switching

9.   For SONET rings, one subchannel OC-12 can be switched to OC-96 channel in the following architecture: [1]

A. BLSR

B. ULSR

C. UPSR

D. Star

10.   In the following Broadcast and Select WDM network, packet collision might occur at the destination: [1]

A. ShuffleNet network

B. Single hop network

C. WRON network

D. Multihop network

11.

A multimode step-index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm. If the core refractive index is 1.46, the normalized frequency for the fiber is   [2]

A. 74.73

B. 73.7

C. 78.3

D. 76.9

12.

A step-index fiber has a core index of refraction $n_1 = 1.425$. The cut-off angle for light entering the fiber from air is found to be 8.5°. the numerical aperture and the index of refraction of the cladding of this fiber would be

[2]

A. 0.154, 1.417

B. 0.148, 1.45

C. 0.139, 1.25

D. 0.148, 1.417

13.

A 5 km optical link consists of multimode step-index fiber with a core refractive index of 1.5 and a relative refractive index difference of 1%. The delay difference between the slowest and fastest modes at the fiber output is   [2]

  A. 100 ns

  B. 250 ns

  C. 400 ns

  D. 500 ns

14.

A Fabry-Perot injection laser diode with an active cavity length of 500 μm is operating at 850 nm. The wavelength separation between the successive modes in the cavity if the refractive index of the cavity is 3.6 is given by   [2]

(a) 0.4 nm

(b) 0.8 nm

(c) 0.2nm

(d) 0.6 nm

15.

An optical power of 2 mW is launched into an optical fiber having an attenuation of 0.5 dB/km. If the fiber optic link is 170 km , then the output power from the optical link would be   [2]

A. 3.12 pW

B. 4.24 pW

C. 5.66 pW

D. 6.24 pW

16.
Photons of energy 1.53×10^{-19} J are incident on a photodiode which has a responsivity of 0.75 A/W. If the optical power level is 10µW, then the photocurrent generated is   [2]

A. 4.5 µA

B. 8.9 µA

C. 7.5 µA

D. 6.9 µA

17.

A photodiode has a quantum efficiency of 65% when photons of energy 1.5×10^{-19} J are incident on it. At what wavelength is the photodiode operating?   [2]

A. 0.85 µm

B. 0.95 µm

C. 1.32 µm

D. 1.55 µm

18.

A step index fiber with NA=0.20 supports 1000 modes at an wavelength of 850 nm. How many modes does the fiber support at 1550nm?   [2]

A. 250

B. 300

C. 350

D. 400

19.

In a 2x2 fiber FBT coupler an optical power of 50 μW is launched into port 1. The measured output power at port 2, 3 (throughput port) and 4 (coupled port) are 0.003, 23.0, 24.5 μW respectively. The excess loss of the coupler would be   [2]

a.   0.22 dB

b.   0.33 dB

c.   0.45 dB

d.   0.12 dB

20.

A p-n junction photodiode, on an average, generates one electron hole pair per five incident photons at a wavelength of 0.9 μm. Assuming all the photogenerated electrons are collected, the quantum efficiency of the diode will be   [2]

   A.   10 %
   B.   20 %
   C.   30 %
   D.   40 %

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Group B

Q1.

(a)   Define beat length and mode field diameter (MFD) of single mode optical fiber.

(b)   Explain the loss mechanisms due to absorption, scattering and bending in optical fibers.
                                                                            [2+3]

Q2.

(a)   Define modulation band width of LED.

(b)   Explain with diagram the working principle of DFB laser diode and compare it
      with F-P laser diode.
                                                                            [2+3)
Q3.

Explain with diagram the principle of operation of RAPD photodetector. What are the factors
that determine the response speed of the photodetector?   [3+2]

Q4.

(a)   Explain the functions of components of EDFA architecture used for bi-directional
pumping.

(b)   Explain how traffic is resumed in case of UPSR SONET ring and BLSR SONET ring
network during node failure.   [2+3]

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