# BE/Insem/APR - 203
# B.E. (E & TC)
# BROADBAND COMMUNICATION SYSTEMS
## (2015 Pattern) (Semester - II)

*Time : 1 Hour]*                                                    *[Max. Marks : 30*

*Instructions to the candidates :*

1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to the right indicate full marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *Assume suitable data, if necessary.*

*Q1)* a) What are Graded Index Fibers? Explain with diagram how ray transmission takes place in GI Fiber. **[4]**

b) A multimode step index fiber having the core refractive index of 1.5, cladding refractive index of 1.38, core radius of 25μm operates at wavelength of 1300nm. **[6]**

   Calculate :
   i) Numerical Aperture
   ii) Normalized Frequency
   iii) Total number of modes in the fiber.

OR

*Q2)* a) Enlist & explain any four losses in optical fiber. **[4]**

b) Compare PIN photo diode & APD on the following points. **[6]**
   i) Responsivity
   ii) Speed
   iii) Sensitivity

*Q3)* a) Explain key system requirements to establish point-to-point optical fiber link. **[4]**

b) A 1550 nm single mode digital fiber optic link needs to operate at 622 Mbps over 80 km without amplifier. A single mode laser launches an average optical power of 13dBm into the fiber. The fiber has a loss of 0.35 dB/km and there is a splice with loss of 0.1 dB every kilometer. The coupling loss at the receiver is 0.5 dB and the receiver uses an lnGaAs APD with a sensitivity of -31 dBm. Excess noise penalties are predicted to be 1.5 dB. Set up an optical power budget for this link and find the system margin. **[6]**

OR

*Q4)* a) Explain lateral and angular misalignment losses in fiber, with diagram.**[4]**

b) Digital optical fiber link has following rise time components.
Source LED : 8 nsec
Fiber cable : intermodal 9 ns/km.
Intra modal : 2 ns/km
Detector (APD) : 3 nsec
The desired link length without repeaters is 5 km and the required optical bandwidth is 6 MHz. Determine system rise time. **[6]**

*Q5)* a) What is WDM? Enlist applications & components for WDM. **[4]**

b) A four port multimode fiber FBT coupler has 60 µw optical power launched into port 1. The measured output power at ports 2, 3 and 4 are 0.004, 26.0 and 27.5 µw respectively. Determine the excess loss, the insertion losses between the input and output ports, the cross talk and the split ratio for the device. **[6]**

OR

*Q6)* a) Explain working principle of Fiber Bragg Grating. **[4]**

b) Compare the following optical amplifiers based on working principle, amplification gain and drawbacks. **[6]**
   i) SOA
   ii) EDFA

✳ ✳ ✳