BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, RAJASTHAN
First Semester 2016-2017
Comprehensive Examination (Part A + Part B)

Course no: EEE G591 Max. Marks :80
Course Title: Optical Communication . Weightage : 40%
Date : 14-12-2016 Duration : 3Hrs

Part A (Closed-Book) M.M.: 40 Tentative Duration: 90Minutes.

Q.1: Discuss important design issues to be taken in Soliton system design mentioning clear specifications. In a fiber with GVD parameter of $1ps^2$ /km , the 20 Gbps soliton system sees the dispersion length as 100 km, comment on the interaction issues.Also predict safe link length and suggest some suggestion to improve this.

(7)

Q.2:Explain the working of a flat gain EDFA with its typical performance parameters and limitations. Discuss appropriate two stage circuits to overcome its limitations using suitable block diagram.

(7)

Q.3: A lightwave system is to be designed at 1.55μm for a single channel bit rate of 10Gbps for a 400 Km link Show the appropriate system blocks needed to implement the project with relevant specifications.

(7)

Q.4:Discuss behavior of chirped pulse propagation through fiber and comment on the influence of chirped parameter over pulse broadening with some specific example. Discuss important influence of dispersion over allowable bit rate through a fiber when a narrow source close to zero wavelength is used.

(7)

Q.5: Write short notes on any two of the following:

(i) Arrayed wave guide router and its performance analysis.
(ii) Heterodyne Synchronous detection and ASK receiver performance.
(iii) High speed optical Transmitter specifications and related power penalty.

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Part B (Open-Book) M.M.: 40 Tentative Duration: 90 Minutes.

Note: Please fill the blanks with appropriate answers OR strike off the wrong words as per the question. (1 to 10 each one marks and 11 to 25 two marks each)

Q.1: Typical FWHM of an LED is ----nm and semiconductor laser is ----------nm.

Q.2: In a standard SM fiber the maximum B.L can be achieved at -------- using ----------type fibers.

Q.3: A graded index multimode fiber provides minimum dispersion for α=2 as 1.2 ns then in a SI fiber having same core size, axis index and cladding index the corresponding delay and supporting data rate would be –----------and ----------respectively if Δ value is 0.01.

Q.4: A soliton having 4 mW peak power in lossless fiber would require a input peak power of value ----------when using lumped line amplifier with gain of 20dB in the system and this would be more / less if the required gain increases.

Q.5: A semiconductor laser with $\Delta\lambda$ as 1 nm in a standard S M Fiber with S as 0.05ps/km-nm^2 at 1.55μm provide B.L nearly -- Gbps.km and this will increase/decrease if a DSF fiber is used..

Q.6: Usually V parameter is kept in the range of ----------to --------for proper single mode operation and as the wavelength of signal decreases the influence on data rate will ----------.

Q.7: Usually fiber birefringence cause ----------to limit the high speed communication and if the PMD parameter is 0.8 unit , the corresponding induced rms delay for a 100 km link would be ----------.

Q.8: For an optical amplifier gain medium having $\Delta\nu_g$ as 10 THz, and max amplifier gain of 30dB the FWHM of the amplifier would be ---------- THz and this value will be more/ less ,if the gain becomes 20dB.

Q.9: For a SRS the fiber loss is 0.1 dB/km having a 100 km length , the effective fiber length would be ---------- and this would be more/ less for a fiber with loss as 0.2 dB/km.

Q.10: Dispersion limited bit rate dependence on length least when a narrow / large spectral width source is used and show a upper limit of ------ ----------data rate for a 100 km link with appropriate order of β having 0.2 unit.

Q.11: Stimulated Brillouin scattering in silica fiber is available in forward/backward/ both direction and scattered frequency is up shifted / downshifted .

Q.12: The reason for gain saturation in SOA is---------- ---------- and the possible limitations are ---------- ----------.

Q.13: For a WDM system having f_d as channel spacing and average GVD as β , the four wave mixing mismatch can be expressed in those terms as --- ----------and to avoid FWM local D value would be nearly----------.----------.

Q.14: In a semiconductor laser with 100 μm cavity length and index of 3.5, the frequency separation between adjacent longitudinal modes would be ---------- and contained number of modes would be ----------if the gain bandwidth is 16 THz.

Q.15: A Synchronous heterodyne receiver requires $\Delta\nu$ as as ---------- Hz for a 10Gbps-whereas asynchronous ASK receiver needs upto ---------- **Hz.**

Q.16: A 40 km link just becomes bandwidth limited for a 10Gbps for a source $\Delta\lambda$ as 1nm but can be corrected by 4cm chirped grating. The dispersion parameter of the grating and fiber would be respectively as -- ----------.

Q.17: In a FP filter for 90% reflectance the number of channels to be selected for spectral efficiency of 0.8 would be nearly ----------.

Q.18: In a fundamental Soliton system with a pulse FWHM of 20 ps and GVD as 2 unit, the needed T_0 and P_0 would be respectively ---------- ----------.

Q.19: Heterowavelength linear cross talk penaltyfor a BER of 10^{-6} is found to be 1.0 dB. The expected channel spacing for a 20Gbps WDM system would be ---------- and for a 10^{-9} BER performance the penalty would be more/less.

Q.20: An optical receiver working at 10^{-9} BER. Assuming current for 0 state as 10% of the 1 state, the appropriate I_d would be ----------time of the noise level σ_1 of 1 state. (use $\sigma_1 = 2\sigma_0$)

Q.21: In a soliton system if the dispersion length and β_2 are 100 km and 1 ps^2 /km , then the system length for a 10Gbps would be ---------- ----------**.**

Q.22: In an optical system MPN induced penalty can be ignored at 1.3 μm(D=1ps/km.nm) with a source having $\Delta\lambda$ as 2nm for 1Gbps upto a distance of ---------km. This system provides more/less power penalty if the λ is changed to 1.55μm.

Q.23: Heterowavelength linear cross talk for a BER of 10^{-6} is found to be ---**dB,** if the channel spacing for a 10Gbps WDM system is kept 14 GHz and for 25 GHz channel spacing this penalty would be --------**dB**----------.

Q.24:In an SOA an encoded signal at 193.5 THz is passed to achieve a wavelength conversion with in cw laser at 193 THz employing FWM technique. The output signal will have the frequency as --------- **THz**---------- and format will be same/inverted.

Q.25:ASE and accoustic induced jitter depends on system length with the order as ------- ------- and ---------- **respectively** and can be reduced by using ---------- ----------.