FEDERAL UNIVERSITY OF TECHNOLOGY, OWERRI
SCHOOL OF ENGINEERING AND ENGINEERING TECHNOLOGY
DEPARTMENT OF ELECTRICAL/ELECTRONIC ENGINEERING
HARMATTAN SEMESTER EXAMINATION; 2019/2020 SESSION
COE 505: OPTICAL FIBER TRANSMISSION.
INSTRUCTION: ANSWER FIVE (5) QUESTIONS ONLY. TIME: 3 HRS

QUESTION 1:
(a). Write an informative note on cladding. Give reasons why cladding must have lower refractive index. (6 marks)

(b). An optical fiber and its cladding have refractive indexes of 1.535 and 1.490 respectively. Calculate numerical aperture and the acceptance angle. (5 marks)

(c). Sketch types of multimode fiber that is known to you. (2 marks). Write out what the two types have in common and the difference between them. (4 marks).

(d). Comment on single mode fiber. (3 marks)

QUESTION 2:
(a) What is Rise Time budgeting? (2 marks)

(b) Distinguish between Rise Time and Power Budgeting (4 marks)

(c) What are the factors that affects rise time budgeting and consequently limit the system speed. (4marks)

(d) Consider a 10km long single mode fiber optic communication link which is to operate at a bit rate of 1Gb/s using a return-to-zero data format. If the combined source and drive circuitry rise time is 10ns and the receiver front-end bandwidth is 800MHz, determine what must be the minimum allowable fiber material dispersion optical source line width product so that the system rise time remain within tolerable limits. Neglect any effects of waveguide dispersion. (10 marks)

QUESTION 3:
(a) Define bandwidth as it applies to fiber-optic cable. What units are used to express bandwidth? (3 marks)

(b) What is regeneration and optical amplifier in fiber optic network, give reasons why both are needed. What is another name for regeneration? (4 marks)

(c) Write out ways to overcome the attenuation experienced by a signal as it travels over-fiber optic cable. (3 marks)

(d) When considering link power budget calculations, mention areas where the optical power loss occurs. (3 marks)

(e) Determine the required output power of an LED source in fiber optic communication link given that η_c=0.6, p_r=-25dBm, $I_c = I_s$=0.5dB, α_F=1dB/km, L = 15km, SM = 6dB and the number of connectors and splices put together is eight. (7 marks)

QUESTION 4:
(a) How many modes would a Step–Index fiber with a core 100μm in diameter and a numerical aperture of 0.29 transmit at 850nm? (5 marks)

(b) Is it possible to build much longer point to point links using fiber than conventional wire cables? Give reasons for your answer. (5 marks)

(c) In order to get the digit bits down the fiber optic cable, mention the light emitting device required. Then write an informative note to distinguish them. (5 marks)

(d) A fiber of 100m length has P_{in}=10μw and P_{out} = 9μw. Find the loss in dB/km. (5 marks)

QUESTION 5
(i) Differentiate between an active and passive coupler as used in fiber optic network.(4 marks)

(ii) What is switching communication network? (4marks)

(iii) What network device is used to interconnect two networks with different information protocols? (2 marks).

B. (i) with a suitable diagram show the losses encountered in a passive coupler used in a Linear bus network.(3 marks)

(ii) A network of linear buses having 5 stations is assumed to have 10 % of power that is removed from the bus. Calculate [a] the tap loss [b] throughput coupling loss. (4marks)

(iii) Sketch the topology of a simple linear bus consisting of 5 uniformly spaced stations. (3marks).

QUESTION 6

A (i) Three linear buses having 5, 10 and 50 stations respectively have the following details: $C_T = 10\%$, $L_{tap} = 10dB$, $L_i = 0.5dB$ and $L_c = 1.0dB$. If the stations are 500m apart with attenuation of 0.4dB/Km. At 1300nm the fiber loss is 0.2dB. Determine for 5 stations only: [a] the connected loss [b] the tap loss [c] fiber loss and [d] intrinsic loss. (10 marks)

B. What do you understand by the term dynamic range of a linear bus? Hence calculate the dynamic range of the above question for 5 and 10 stations. Comment on your result. (10marks).

QUESTION 7

A. State the full meaning of the following acronyms used in optical networks (a) SPE (b) STS-N (c) OC (d) POH (e) ATM (5marks)

B. Write briefly and highlighting essential points on SONET (5maks)

C. Explain the three main features used in SONET/SDH protection switching. (6 marks)

D. Sketch and indicate appropriately a 2-Fiber unidirectional network and a 4-Fiber bidirectional network. (4 marks)