

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Electronics and Telecommunication Engg.

Curriculum Scheme: Rev2012

Examination: BE Semester:VII

Course Code: ETC701 and Course Name: Image and Video Processing

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following is the best sensor to acquire the digital image in optical range?
Option A:	Point sensor
Option B:	Line sensor
Option C:	Array Sensor
Option D:	Multispectral sensor
2.	If an image has 128 intensity levels, the number of bits per pixel in the image is
Option A:	6
Option B:	5
Option C:	8
Option D:	7
3.	If two images A and B have a sampling rates of 400dpi and 600 dpi, then
Option A:	A has better spatial resolution than B
Option B:	B has more spatial resolution than A
Option C:	Both A and B have same spatial resolution
Option D:	Both A and B have no spatial resolution
4.	Which of the following distance measures is the best?
Option A:	City block distance
Option B:	Chess board distance
Option C:	Euclidean Distance
Option D:	Pixel to boundary distance
5.	Which statement is true with respect to High pass Filter?
Option A:	High Pass filter removes high Frequencies in the image
Option B:	High pass filter removes Gaussian noise from image
Option C:	High Pass filter retains all low frequencies
Option D:	High pass filter enhances the edges
6.	The salt and pepper noise is eliminated by

Option A:	Median filter
Option B:	Low pass filter
Option C:	High pass filter
Option D:	Gaussian filter
7.	Log transformation is used in which of the following applications?
Option A:	To stretch the histogram
Option B:	To improve the contrast of the image
Option C:	To generate image negative
Option D:	To enhance the scale of visibility where the pixel values seem visually very near to each other.
8.	Histogram equalization is not 100% uniform in digital images due to
Option A:	One to one mapping of pixels
Option B:	Due to sampling and quantization process
Option C:	Due to calculation of CDF
Option D:	Due to rounding off of gray levels
9.	The Mexican hat response of the filter is produced by
Option A:	LOG operation
Option B:	Morphological operation
Option C:	High pass filter
Option D:	Homomorphic filter
10.	The erosion by a structuring element $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}$ on a full bright square image with all the values equal to 255 of gray scale will result in
Option A:	A diagonal bright line
Option B:	A horizontal bright line
Option C:	A vertical bright line
Option D:	The image vanishes completely
11.	The Skeleton of an image is obtained by applying
Option A:	A series of segmentation operations
Option B:	A series of dilation operations
Option C:	A series of connectivity operations
Option D:	A series of erosion operations
12.	The correct equation for illumination Y is given by
Option A:	$0.59G + 0.3R + 0.11B$
Option B:	$0.59R + 0.3B + 0.11G$
Option C:	$0.6G + 0.3B + 0.1R$
Option D:	$0.59B + 0.11G + 0.3R$
13.	Which of the following has the best energy compaction?

Option A:	DFT
Option B:	DWT
Option C:	Hadamard Transform
Option D:	K L transform
14.	The following effect is observed in an image when the scaling property of DFT is applied on an image
Option A:	The linear phase changes to nonlinear phase
Option B:	The time period is shifted by some amount
Option C:	The size of the image increases or decreases
Option D:	The rotation of the image changes in diagonal direction
15.	The Hough transform is used to
Option A:	Convert the image from time domain to frequency domain
Option B:	Convert the image from frequency domain to time domain
Option C:	Coordinate space to parametric space
Option D:	Parametric space to spatial coordinate space
16.	The mask $\begin{bmatrix} -1 & -1 & -1 \\ 2 & 2 & 2 \\ 1 & 1 & 1 \end{bmatrix}$ when applied to an image results in
Option A:	Detection of diagonal edge
Option B:	Detection of Horizontal edge
Option C:	Detection of vertical edge
Option D:	Does not detect any edge
17.	The MPEG is the standard used to represent
Option A:	An audio compression
Option B:	Image compression
Option C:	Video compression
Option D:	Is not a compression standard
18.	The motion vector is used to
Option A:	Calculate the distance between two pixels in different frames
Option B:	Calculate the distance between two pixels in same frame
Option C:	Calculate the path between two pixel values
Option D:	Calculate the distance between two pixels for face recognition
19.	The coding most suitable for coding video is
Option A:	Delta modulation coding
Option B:	Pulse code modulation
Option C:	Huffman coding
Option D:	Predictive coding
20.	The number of frames per second used in motion pictures are
Option A:	50 frames/ second

Option B:	30 frames / second
Option C:	24 frames/ second
Option D:	72 frames/ second

Q.2	Solve any Two Questions out of Three 10 marks each
A	State and prove the following DFT properties 1. Linearity Property 2. Convolution property
B	Derive the equation for histogram equalization and prove that the equalized histogram represents uniform distribution.
C	Explain any one method of motion vector calculation.

Q.3	Solve any Two Questions out of Three 10 marks each																																																
A	<div>Apply median filter on the following image</div> <table><tr><td>29</td><td>31</td><td>0</td><td>10</td><td>25</td><td>0</td></tr><tr><td></td><td>20</td><td>30</td><td>15</td><td>25</td><td>5</td></tr><tr><td>10</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>5</td><td>10</td><td>15</td><td>10</td><td>25</td><td>30</td></tr><tr><td>30</td><td>25</td><td>10</td><td>5</td><td>15</td><td>0</td></tr><tr><td>0</td><td>5</td><td>0</td><td>10</td><td>5</td><td>15</td></tr><tr><td>15</td><td>25</td><td>0</td><td>0</td><td>10</td><td>15</td></tr><tr><td>30</td><td>20</td><td>10</td><td>15</td><td>0</td><td>5</td></tr></table>	29	31	0	10	25	0		20	30	15	25	5	10						5	10	15	10	25	30	30	25	10	5	15	0	0	5	0	10	5	15	15	25	0	0	10	15	30	20	10	15	0	5
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B	Draw different masks used for edge detection and compare their performance with justification.																																																
C	Compare the performance of Gradient operator and Laplacian operator? Which is the best for edge detection?																																																

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: **Electronics and Telecommunication**

Curriculum Scheme: Rev2016

Examination: BE Semester VII

Course Code: ECC701 and Course Name: Microwave Engineering

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks. (2 marks each)
1.	Which of the statements is not true for the microstrip line?
Option A:	It is a planer transmission line.
Option B:	Its power handling capacity is small.
Option C:	Characteristic impedance(Z_0) of microstrip line can be controlled by controlling its width(W) only i.e. controlling dimensions in one plane.
Option D:	It is only possible to control its characteristics impedance by controlling width and height of the substrate simultaneously.
2.	The ferrite devices work on the principle of -
Option A:	Faraday's Law of EM Induction
Option B:	Hall effect
Option C:	Faraday's Rotation Effect
Option D:	Photoemission effect
3.	Find S_{11} for a series element $Z=200\ \Omega$. Take characteristic impedance $Z_0=75\ \Omega$.
Option A:	$S_{11}=0.5$
Option B:	$S_{11}=0.57$
Option C:	$S_{11}=1.75$
Option D:	$S_{11}=0$
4.	Find cutoff frequency for the dominant mode of a dielectric filled circular waveguide with $\epsilon_r=2.08$. The radius of the waveguide is 0.5 centimeter.
Option A:	15.92 GHz
Option B:	11.32 GHz
Option C:	12.18 GHz
Option D:	14.45 GHz
5.	For the same defect pattern, small chip size has _____ yield as compared to large chip size.
Option A:	Large
Option B:	Small
Option C:	Cannot say anything
Option D:	Very small
6.	Which of the following devices is a two port non-reciprocal phase shifter with a phase difference of 180° between forward and backward direction of propagation?

Option A:	Isolator
Option B:	Gyrator
Option C:	Circulator
Option D:	Directional coupler
7.	The input power in a two-hole directional coupler is 10 mW. The coupler has a coupling coefficient of 20 dB. Calculate power in coupled port
Option A:	0.1 nW
Option B:	0.1 mW
Option C:	9.9 mW
Option D:	0.2 mW
8.	The major advantage of a travelling wave tube (TWT) over a klystron lies in it -
Option A:	Simple construction
Option B:	Low cost
Option C:	Higher gain and bandwidth
Option D:	Low gain
9.	Which of the following statements is true for Gyrotron?
Option A:	It uses resonant cavity
Option B:	It uses slow wave structure
Option C:	It is used for low frequency.
Option D:	The RF field interacts with the electron in a cyclotron motion in the presence of strong static magnetic field
10.	Which of the following statement is not true for Tunnel diode –
Option A:	It is heavily doped semiconductor p-n junction
Option B:	Its working is based on tunnel effect which is quantum mechanical effect
Option C:	Tunneling require empty states on one side of the barrier and filled states on other side of the barrier
Option D:	It is a lightly doped semiconductor p-n junction.
11.	Which of the following statements is true for a BARITT diode?
Option A:	A BARITT diode is much less noisy as compared to an IMPATT diode.
Option B:	They have more bandwidth
Option C:	High power output possible
Option D:	A BARITT diode are much more noisy as compare to IMPATT diode
12.	Which of the following possibilities for semiconductor devices is indication of negative resistance behavior?
Option A:	With increase in voltage, current increases.
Option B:	Voltage across device and current through it is 360 degree out of phase
Option C:	With increase in voltage, current remains constant.
Option D:	Negative differential mobility in bulk semiconductors by transferring electrons from high-mobility energy bands to low-mobility energy bands with increase in voltage
13.	If the required normalized susceptance of the single shunt stub is $-j1$ and if the characteristic impedance $Z_0 = 75 \text{ Ohm}$, then the length of short-circuited shunt stub will be -

Option A:	$L = 0.25\lambda$
Option B:	$L = 0.125\lambda$
Option C:	$L = 0.35\lambda$
Option D:	$L = 0.5\lambda$
14.	In single stub matching, the stub should be inserted at a point on the line where the normalized conductance is-
Option A:	0
Option B:	infinity
Option C:	1
Option D:	0.5
15.	Which of the following statements is not true for waveguide tee (three port junction)?
Option A:	They used to split the power
Option B:	A three port, lossless, reciprocal network can never be designed with all its ports matched
Option C:	A three port, lossless, reciprocal network can be designed with all its ports matched
Option D:	They used to combine the power
16.	What is the effect of increase in gap transit angle θ_g in Two Cavity Klystron?
Option A:	Velocity modulation decreases.
Option B:	Velocity modulation increases
Option C:	Velocity modulation remains constant
Option D:	Coupling between the electron beam and the buncher cavity increases
17.	Barratters are used for the measurement of -
Option A:	VSWR
Option B:	Power
Option C:	Impedance
Option D:	Frequency
18.	In travelling wave tube amplifier helical structure is used to -
Option A:	Reduce noise
Option B:	Increase the efficiency
Option C:	Reduce the axial velocity of RF field
Option D:	Ensure broad band operation
19.	A travelling wave tube operates under the following condition: Beam Voltage = 3kV, Beam current = 30mA, Characteristics impedance of the helix = 10Ω , Circuit length = 55 and frequency = 9GHz. Calculate output power gain A_p in decibel.
Option A:	51.8 dB
Option B:	100 dB
Option C:	59.52 dB
Option D:	66.42 dB
20.	Manley-Rowe power relations are useful for-
Option A:	Predicting nonlinear behavior of Gunn diode
Option B:	Explaining tunneling phenomenon of tunnel diode

Option C:	Explaining power loss in Gunn diode
Option D:	Predicting power gain in parametric amplifiers

Q2.	Solve any Four out of Six.	5 marks each
A	Explain method to measure VSWR.	
B	Derive expression for modulated velocity in case of Two cavity klystron amplifier.	
C	Explain how Gunn diodes can exhibit dynamic negative resistance?	
D	A air filled rectangular waveguide with waveguide dimensions $a = b = \sqrt{6}$ is extended in z direction. The signal frequency is 10 GHz. The magnetic field in z direction is given as $H_z = H_0 \cos \cos \left(\frac{\pi x}{\sqrt{6}} \right) \cos \cos \left(\frac{\pi y}{\sqrt{6}} \right) A/m$. Identify mode of propagation and calculate cutoff frequency.	
E	Compare Hybrid MICs with monolithic MIC.	
F	List medical applications of Microwave engineering and explain any one in brief.	
Q3.	Solve any Two Questions out of Three.	10 marks each
A	Describe various modes of operation in Gunn oscillator.	
B	An X-band pulsed cylindrical magnetron has following parameters: Anode Voltage =32KV, Anode current = 84A, Magnetic flux density = 0.01 Wb/m ² , Radius of cathode cylinder =6cm and Radius of vane edge to center =12cm. Calculate a) The cyclotron angular frequency b) The Hull cutoff voltage for a fixed B ₀ c) The Hull cutoff magnetic flux density for a fixed V ₀	
C	A rectangular waveguide with cross-section dimensions a x b is extended in x direction. Derive expressions for field configuration inside the waveguide for TE mode.	

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: BE Electronics and Telecommunication Engineering

Curriculum Scheme: R2012

Examination: BE Semester VII

Course Code: ETC702 and Course Name: Mobile Communication

Time: 2 hour

Max. Marks: 80

Note to the students: - All the Questions are compulsory and carry equal marks.

Q1.	Choose the correct option for following questions.
1.	___ occurs when the radio path between a TX and RX is obstructed by a surface with sharp irregular edges
Option A:	diffraction
Option B:	scattering
Option C:	Refraction
Option D:	diversity
2.	Walsh codes are used as channelization codes in ____ .
Option A:	AMPS
Option B:	GSM
Option C:	WCDMA
Option D:	cdma2000
3.	GPRS is an overlay on the top of the --- physical layer and network entities
Option A:	IS 95
Option B:	GSM
Option C:	AMPS
Option D:	ETACS
4.	What is the minimum amount of RF spectrum needed for an FDD LTE radio channel?
Option A:	2.8 MHz
Option B:	1.4 MHz
Option C:	3 MHz
Option D:	2 MHz
5.	Downlink modulation used in WCDMA is
Option A:	QPSK
Option B:	BPSK
Option C:	8FSK
Option D:	QAM
6.	GSM has RF channel bandwidth of
Option A:	250 KHz
Option B:	200 KHz
Option C:	100 KHz
Option D:	1.25 MHz

7.	__ antenna has the property of radiating waves more effectively in some direction than others.
Option A:	omnidirectional
Option B:	directional
Option C:	Smart
Option D:	Sectored
8.	If the cell size antenna height is doubled there will be
Option A:	increase in propagation path loss by 6 dB
Option B:	reduction in path loss by 6 dB
Option C:	reduction in path loss by 12 dB
Option D:	no change in path loss
9.	The range of frequencies over which channel can be considered flat
Option A:	coherence bandwidth
Option B:	bandwidth
Option C:	spectrum
Option D:	guard band
10.	Cells which use same set of frequencies or channels are called
Option A:	adjacent cells
Option B:	cluster cells
Option C:	co channel cells
Option D:	Intercells
11.	Minimum frequency band required for 3X cdma technology is
Option A:	1.25 MHz
Option B:	7.5 MHz
Option C:	5 MHz
Option D:	10 MHZ
12.	Time slot period in GSM is
Option A:	570 ms
Option B:	577 microseconds
Option C:	577 ms
Option D:	570 seconds
13.	IMSI number used as GSM identifier is of __ digits
Option A:	9
Option B:	15
Option C:	12
Option D:	10
14.	The early FM push-to-talk telephone systems were used in
Option A:	half duplex
Option B:	simplex
Option C:	full duplex
Option D:	modulation

15.	The access point in LTE is called as
Option A:	MS
Option B:	BTS
Option C:	eNodeB
Option D:	GPRS
16.	A cellular communication area is covered with 12 clusters having 7 cells in each cluster and 16 channels assigned in each cell. How many number of channels will be available per cluster
Option A:	212
Option B:	112
Option C:	100
Option D:	23
17.	X2 Interface is used for
Option A:	eNB and MME
Option B:	eNB and servicing
Option C:	Inter eNB
Option D:	EUTRAN
18.	Multiple modulation and coding schemes are observed in
Option A:	EDGE
Option B:	GSM
Option C:	GPRS
Option D:	HSCSD
19.	Cdma2000-1xRTT system supports a typical throughput of
Option A:	154kbps
Option B:	144kbps
Option C:	200kbps
Option D:	200mbps
20.	Network planning in CDMA systems involves
Option A:	frequency planning
Option B:	PN code planning
Option C:	power planning
Option D:	bandwidth planning

Q2	Solve any Four out of Six.	5 marks each
A	Explain the microcell zone concept.	
B	Explain Space Division Multiple Access.	
C	List IS 95 air interface specifications.	
D	Compare WCDMA and cdma2000.	
E	What are the key features of EDGE?	
F	Write a short note on types of large scale fading.	

Q3	Solve any Two Questions out of Three	10 marks each
A	Explain GSM architecture with a suitable diagram in detail.	
B	Explain adaptive multi antenna techniques for 4G systems.	
C	Explain methods to improve capacity of a cellular system in detail.	

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021

Program: **Electronics and Telecommunication Engineering (CBCGS)**

Curriculum Scheme: Rev 2016

Examination: BE Semester VII

Course Code: ECC702 and Course Name: Mobile Communication System

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The design process of selecting and allocating channel groups for all of the cellular base stations within a system is called _____.
Option A:	Footprint
Option B:	frequency reuse
Option C:	Cluster
Option D:	Handoff
2.	The propagation model that estimates radio coverage of a transmitter is called _____.
Option A:	Large scale propagation model
Option B:	Small scale propagation model
Option C:	Sector channel model
Option D:	Ricean model
3.	What does path loss exponent indicate?
Option A:	Rate at which path loss decreases with distance
Option B:	Rate at which path loss increases with distance
Option C:	Rate at which path loss decreases with power density
Option D:	Rate at which path loss increases with power density
4.	How many users or voice channels are supported for each 200KHz channel in GSM?
Option A:	Eight
Option B:	Three
Option C:	Sixty four
Option D:	Twelve
5.	The fundamental time unit of LTE transmission is a _____.
Option A:	radio frame
Option B:	Subframes
Option C:	Slots
Option D:	Symbols
6.	What location management feature is supported by 4G?
Option A:	Concatenated Location Registration
Option B:	Concurrent Location Register
Option C:	Concatenated Management

Option D:	Collated Location Registration
7.	Which property of OFDMA system allows adjacent subcarriers to be used without interference?
Option A:	Orthogonality
Option B:	Orthodoxy
Option C:	Octagonality
Option D:	Originality
8.	The technique in which single omnidirectional antenna at the base station is replaced by several directional antennas is _____ .
Option A:	Cell Splitting
Option B:	Microcell zone concept
Option C:	Cell Sectoring
Option D:	Cell multiplication
9.	The maximum radiated power available from a transmitter in the direction of maximum antenna gain, as compared to an isotropic radiator is _____ .
Option A:	Effective isotropic Radiated Power
Option B:	Effective isotropic Received Power
Option C:	Effective isotropic Radiated Pulse
Option D:	Effective isotropic Received Pulse
10.	Which is the main protocol that transfers packets in a GPRS Core network?
Option A:	GTP
Option B:	SSTP
Option C:	SCTP
Option D:	STTP
11.	The channelization codes used in W-CDMA are:
Option A:	Walsh codes
Option B:	Orthogonal variable spreading factor (OVSF) codes
Option C:	Quasi-orthogonal codes
Option D:	Kasami codes
12.	_____ is a transmission method used in MIMO wireless communications to transmit encoded data signals independently.
Option A:	STTD
Option B:	Spatial Multiplexing
Option C:	Collaborative Uplink MIMO
Option D:	MU-MIMO
13.	Grade of service refers to
Option A:	Accommodating large number of users in limited spectrum
Option B:	Ability of a user to access trunked system during busy hour
Option C:	Two calls in progress in nearby mobile stations
Option D:	high speed users with large coverage area
14.	Coherence time is _____ .
Option A:	Directly proportional to Doppler spread

Option B:	Directly proportional to square of Doppler spread
Option C:	Inversely proportional to Doppler spread
Option D:	Directly proportional to twice of Doppler spread
15.	EDGE is the new radio interface technology with enhance modulation and increase GPRS data rate by up to
Option A:	Three times
Option B:	Four times
Option C:	Six times
Option D:	Eight times
16.	What is the name of a Base Transceiver Station in 2G system equivalent in a 4G LTE system?
Option A:	nodeB
Option B:	eNodeB
Option C:	aNodeB
Option D:	nodeBPro
17.	A spectrum of 30MHz is allocated to a cellular system which uses two 25KHz simplex channels to provide full duplex voice channels. What is the number of channels available per cell for 4 cell reuse factor?
Option A:	150 channels
Option B:	60 channels
Option C:	50 channels
Option D:	85 channels
18.	The no. of cell in the cluster can be calculated by_____ formula.
Option A:	$N = i + j + j$
Option B:	$N = i^2 + j^2$
Option C:	$N = i + j - j^2$
Option D:	$N = i^2 + ij + j^2$
19.	_____ is the core network architecture of LTE standard.
Option A:	SAE (System Architecture Evolution)
Option B:	SAP (System Architecture Pro)
Option C:	CAS (Core System Architecture)
Option D:	MAP (Message application part)
20.	Which are three basic propagation mechanisms?
Option A:	path loss, free space and reflection
Option B:	Multi path propagation, reflection, and scattering,
Option C:	reflection, diffraction, and scattering,
Option D:	signal loss, attenuation, and scattering

Q2.	(20 Marks)
A	Solve any Two 5 marks each

i.	What is cell dragging and dwell time?
ii.	Explain SDR in communication.
iii.	Discuss IS-95 CDMA forward channels.
B	Solve any One 10 marks each
i.	Explain Handoff in 2G, 3G and 4G in detail.
ii.	Describe GSM Frame structure.

Q3.	(20 Marks)
A	Solve any Two 5 marks each
i.	List out methods to improve system capacity? Explain any one method.
ii.	Explain power control in IS-95.
iii.	Explain multiple antenna techniques.
B	Solve any One 10 marks each
i.	For a given path loss exponent, $n=4$ and $n=3$. find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal-to-interference ratio of 15dB is minimum required for satisfactory forward channel performance of a cellular system. There are six co-channel cells in the first tier and all of them are at the same distance from the mobile. Use suitable approximations.
ii.	Draw and explain 3GPP LTE architecture.

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: Electronics & Telecommunication

Curriculum Scheme: Rev 2012

Examination: BE Semester VII

Course Code: ETC 703 and Course Name: Optical Communication and Networks

Time: 2 Hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The maximum angle at which external light rays may strike the air/glass interface and still propagate down the fiber.
Option A:	Acceptance cone half-angle
Option B:	Acceptance cone
Option C:	Critical angle
Option D:	Angle of incidence
2.	It is a graphical representation of the magnitude of the refractive index across the fiber.
Option A:	Mode
Option B:	index profile
Option C:	numerical aperture
Option D:	refractive index
3.	Single-mode step-index cable has a core diameter in the range of.
Option A:	100 to 1000 micrometer
Option B:	50 to 100 micrometers
Option C:	5 to 15 micrometers
Option D:	8 to 10 micrometers
4.	Attenuation in fiber in general
Option A:	Decreases with increase in length of fiber
Option B:	Increases with increase in length of fiber
Option C:	Increases with decrease in length of fiber
Option D:	Doesn't change with length of fiber
5.	When the mean optical power launched into an 8 km length of fiber is 120 μ W, the mean optical power at the fiber output is 3 μ W. The overall signal attenuation is=
Option A:	20 dB
Option B:	10 dB
Option C:	1.6 dB
Option D:	16 dB
6.	Mie Scattering occurs when the size of the scattering center becomes:
Option A:	Very Smaller than wavelengths at which Rayleigh Scattering occurs
Option B:	Larger than wavelengths at which Rayleigh Scattering occurs

Option C:	Equal to wavelengths at which Rayleigh Scattering occurs
Option D:	Doesn't depend on wavelength
7.	Population inversion is obtained at a p-n junction by _____
Option A:	Heavy doping of p-type material
Option B:	Heavy doping of n-type material
Option C:	Light doping of p-type material
Option D:	Heavy doping of both p-type and n-type material
8.	The absence of_----- in LEDs limits the internal quantum efficiency.
Option A:	Proper semiconductor
Option B:	Adequate power supply
Option C:	Optical amplification through stimulated emission
Option D:	Optical amplification through spontaneous emission
9.	The fraction of incident photons generated by photodiode of electrons generated collected at detector is known as _____?
Option A:	Quantum efficiency
Option B:	Absorption coefficient
Option C:	Responsivity
Option D:	Angel recombination
10.	Which are the two main sources of noise in photodiodes without internal gain?
Option A:	Gaussian noise and dark current noise
Option B:	Internal noise and external noise
Option C:	Dark current noise & Quantum noise
Option D:	Gaussian noise and Quantum noise
11.	Choose the correct statement
Option A:	Rise time of LED is smaller than rise time of LASER
Option B:	Rise time of LED is equal to rise time of LASER
Option C:	Rise time of LED is 2 time smaller than rise time of LASER
Option D:	Rise time of LED is greater than rise time of LASER
12.	In the _____ topology, the data generally circulates bi-directionally.
Option A:	Mesh
Option B:	Bus
Option C:	Star
Option D:	Ring
13.	A linear SONET network can be _____
Option A:	point-to-point
Option B:	multi-point
Option C:	both point-to-point and multi-point
Option D:	single point
14.	Basically, solitons are pulses which propagates through the fiber without showing any variation in _____
Option A:	Amplitude
Option B:	Frequency

Option C:	Shape
Option D:	Amplitude, Velocity and Shape
15.	SONET stands for _____
Option A:	synchronous optical network
Option B:	synchronous operational network
Option C:	stream optical network
Option D:	shell operational network
16.	In OTDM method, optical signals representing data streams from multiple sources are _____ in time to produce a single data stream
Option A:	Interleaved
Option B:	Multiplexed
Option C:	Added
Option D:	Demultiplexed
17.	The _____ Topology forms a central hub to the network which may be either active or passive.
Option A:	Ring
Option B:	Star
Option C:	Mesh
Option D:	Bus
18.	In OTDR test echo occurs when there are:
Option A:	Unwanted multiple reflections
Option B:	No reflections
Option C:	Multiple refractions
Option D:	No refractions
19.	For measuring the shape of input pulse in time-domain intermodal dispersion method, the test fiber is replaced by another fiber whose length is less than ---- of the test fiber.
Option A:	1%
Option B:	5%
Option C:	10%
Option D:	2 %
20.	Scattering losses in optical fiber arise from:
Option A:	Variation of length of fiber
Option B:	Impurities in material
Option C:	Microscopic variations in the material density
Option D:	Variation in dimensions of cladding

Subjective/Descriptive Questions

Q2	Solve any Two Questions out of Three	10 marks each
A	What are the desirable requirements of a good connector? What are the lensing schemes for coupling improvements?	
B	List different types of fiber fabrication techniques and explain any one of them.	

C	Explain OTDR working principle in detail. Mention its limitations.
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Q3.	
A	Solve any Two 5 marks each
i.	Define Spontaneous Emission, Stimulated Emission and Quantum Efficiency.
ii.	Compare Isolators and Circulator.
iii.	Explain Macro-bending loss.
B	Solve any One 10 mark each
i.	Sketch the Refractive Index Profile of SIF and GIF. Derive an expression for Numerical Aperture and Number of Modes in SIF.
ii.	Derive an expression for Responsivity of PIN photodiode. Differentiate PIN and RAPD photodiodes.

University of Mumbai

Examination June 2021

Examinations Commencing from 15th June 2021 to 26th June 2021

Program: **BE Electronics and Telecommunication Engineering**

Curriculum Scheme: Rev-2016

Examination: BE Semester VII

Course Code: ECC703 and Course Name: Optical Communication

Time: 2 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	What is the numerical aperture of the fiber if the angle of acceptance is 16 degree?
Option A:	0.50
Option B:	0.36
Option C:	0.20
Option D:	0.27
2.	The normalized frequency V number of the single mode fiber is decided by:
Option A:	Only the radius of the core of the fiber
Option B:	The radius of the fiber, numerical aperture and the operating wavelength
Option C:	The radius of the core and cladding both
Option D:	Only on the operating wavelength and the numerical aperture
3.	Which law gives the relationship between refractive index of the dielectric?
Option A:	Law of reflection
Option B:	Law of refraction (Snell's Law)
Option C:	Millman's Law
Option D:	Huygen's Law
4.	Which among the following is regarded as an inelastic scattering of a photon?
Option A:	Kerr effect
Option B:	Raman effect
Option C:	Hall effect
Option D:	Miller effect
5.	Which loss is related to the material composition and the fabrication process of the fiber.
Option A:	Scattering loss
Option B:	Absorption loss
Option C:	Dispersion loss
Option D:	Radiative loss
6.	Rayleigh scattering and Mie scattering are the types of _____
Option A:	Splicing losses

Option B:	Non-linear scattering losses
Option C:	Fiber bends losses
Option D:	Linear scattering losses
7.	Dispersion that results from the different group velocities of the various spectral components launched into the fiber from the optical source is known as
Option A:	Chromatic dispersion
Option B:	Material dispersion
Option C:	Polarization dispersion
Option D:	Intermodal dispersion
8.	A non linearity that result in a different transmission phase for the peak of the pulse compared with the leading and trailing pulse edges is known as:
Option A:	Self-phase modulation
Option B:	Cross-phase modulation
Option C:	four-wave mixing
Option D:	Stimulated Raman Scattering
9.	In Kerr effect, induced index change has its proportionality with respect to ____
Option A:	square of electric field
Option B:	cube of electric field
Option C:	cube root of electric field
Option D:	one-fourth power of electric field
10.	A device which converts electrical energy into optical energy is called as _____
Option A:	Optical source
Option B:	Optical coupler
Option C:	Optical isolator
Option D:	Circulator
11.	The ratio of the increase in photon output rate for a given increase in the number of injected electrons is
Option A:	Internal quantum efficiency
Option B:	External quantum efficiency
Option C:	Emitted power efficiency
Option D:	Intrinsic Efficiency
12.	In Lambertian output pattern of LED, the source is _____ bright from all directions.
Option A:	Less
Option B:	Equally
Option C:	More
Option D:	Unpredictably
13.	The frequency of the emitted radiation is related to difference in energy level i.e. $E = E_2 - E_1 = h\nu$. State what h stands for in the given equation?
Option A:	Gravitation constant

Option B:	Planck's constant
Option C:	Permittivity
Option D:	Attenuation constant
14.	A parameter that gives the transfer characteristic of the detector is:
Option A:	Responsivity
Option B:	Quantum efficiency
Option C:	Internal optical power
Option D:	Output power
15.	Optical detectors are square-law devices because they respond to _____ rather than amplitude.
Option A:	Intensity
Option B:	Light
Option C:	Density
Option D:	Photon
16.	Optical Isolators are used to
Option A:	Modulate the light
Option B:	Block any light moving in backward direction
Option C:	Optical to Electrical conversion
Option D:	Amplify the light signal
17.	The heating of the two prepared fiber ends to their fusing point with the application of required axial pressure between the two optical fibers is called as _____
Option A:	Mechanical splicing
Option B:	Fusion splicing
Option C:	Melting
Option D:	Diffusion
18.	At which level of temperature does the oxidation process occur in MCVD?
Option A:	Low
Option B:	Moderate
Option C:	High
Option D:	Unpredictable
19.	A key requirement needed in analyzing an optical link is
Option A:	Desired transmission distance
Option B:	SNR
Option C:	Initial Power level
Option D:	Optical bandwidth
20.	To decide the system performance of optical cable system, which analysis is used:
Option A:	Link power budget
Option B:	Rise time budget
Option C:	Cross- phase modulation

Option D:	Link gain
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Q2 a)	Solve any Two Questions out of Three	05 marks each
A	Explain the various factors contributing to the attenuation in optical fibers.	
B	A silica optical fiber has a core refractive index of 1.48 and cladding refractive index 1.46. Determine (a) The critical angle (b) Numerical Aperture (c) The acceptance angle	
C	Compare: Optical Isolator and Circulator.	
Q2 b)	Solve any One Questions out of Two	10 marks each
A	Derive an expression for the responsivity of an intrinsic photo detector in terms of quantum efficiency of the device and the wavelength of the incident radiation. What are the parameters on which photo detector response time depends ?	
B	Compare Semiconductor optical amplifier with Erbium doped fiber amplifier and Raman amplifier.	

Q3 a)	Solve any One Questions out of Two	10 marks each
A	Sketch and explain the construction of Vertical cavity surface emitting lasers and also state its applications.	
B	List different types of fiber fabrication techniques and explain any one of them.	
Q3 b)	Solve any One Questions out of Two	10 marks each
A	Explain with neat sketches the different types of fiber splicing techniques.	
B	<p>Why link budget is important in optical fiber communication system?</p> <p>An analog optical fiber link of length 2 km employs an LED which launches mean optical power of -10 dBm into a multimode optical fiber. The fiber cable exhibits a loss of 3.5 dB/km with splice losses 1.4 dB .In addition there is a connector loss at the receiver of 1.6 dB. The pin photodiode receiver has a sensitivity of -25 dBm for an SNR of 50 dB and with a modulation index of 0.5. It is estimated that a safety margin of 4 dB is required. Ignoring the effects of dispersion on the link determine the optical power budget for the system operating under the above conditions and ascertain its viability.</p>	