Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Electronics) (Fourth Semester)
(NEP) EXAMINATION, 2025-26

OPTOELECTRONICS AND OPTICAL COMMUNICATION

Paper Code							
B	1	4	1	0	0	3	T

Questions Booklet Series
A

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

(Only for Rough Work)

1. The typical operating wavelengths used in optical fiber communication are :

(A) 450 nm and 550 nm

(B) 650 nm and 700 nm

(C) 850 nm, 1310 nm and 1550 nm

(D) 200 nm and 300 nm

2. The V-number of a fiber depends on :

(A) Core radius, wavelength and numerical aperture

(B) Fiber length only

(C) Refractive index of air

(D) Cladding thickness only

3. The acceptance angle of an optical fiber increase when :

(A) Numerical aperture decreases

(B) Core refractive index decreases

(C) Difference between core and cladding index increases

(D) Wavelength increases

4. The main advantage of using 1550 nm wavelength is :

(A) Higher scattering loss

(B) Higher absorption

(C) Minimum attenuation window

(D) Low numerical aperture

5. A device that reduces the intensity of light in optical fiber communications is :

(A) Compressor

(B) Barometer

(C) Optical attenuator

(D) Reducer

6. The refractive index profile of graded index fiber is generally :

(A) Linear

(B) Parabolic

(C) Exponential

(D) Constant

7. In single-mode fiber, the cut-off V-number is approximately :

(A) 1.0

(B) 2.405

(C) 3.14

(D) 4.0

8. What is dispersion in optical fiber communication ?

(A) Absorption of light pulses

(B) Broadening of transmitted light pulses along the channel

(C) Overlapping of light pulses on compression

(D) Compression of light pulses

9. Meridional rays in graded index fibers follow :

(A) Straight path along the axis

(B) Helical path

(C) Path where rays change angles at core-cladding interface

(D) Curved path along the axis

10. The main source used in long-haul fiber communication is :

(A) LED

(B) Laser diode

(C) Tungsten lamp

(D) Xenon lamp

11. Mie scattering has in-homogeneities mainly in :

(A) Forward direction

(B) Backward direction

(C) Core-cladding interface

(D) All directions

12. Which processes are involved in the purification stage in liquid-phase-technique ?

(A) Filtration, Co-precipitation, Re-crystallization

(B) Decomposition, Filtration, Drying

(C) Doping, Drying, Decomposition

(D) Filtration, Drying, Doping

13. Critical angle depends upon :

(A) Wavelength only

(B) Core diameter

(C) Refractive indices of two media

(D) Fiber length

14. A multimode step index fiber has a normalized frequency of 72. Estimate the number of guided modes.

(A) 2846

(B) 2592

(C) 2432

(D) 2136

15. The elemental semiconductors are not used for optical radiation because of :

(A) Direct band gap materials

(B) Indirect band gap materials

(C) Both (A) and (B)

(D) None of the above

16. Rayleigh scattering and Mie scattering are the types of …….. .

(A) Linear scattering losses

(B) Fiber bends losses

(C) Non-linear scattering losses

(D) Splicing losses

17. Fiber optic cables are immune to :

(A) Electromagnetic interference

(B) Temperature

(C) Pressure

(D) Light

18. P_2O_5 is used as a …….. .

(A) Dopant

(B) Starting material

(C) Cladding glass

(D) Core glass

19. Which of the following materials is not used as a starting material in vapor-phase deposition ?

(A) $SiCl_4$

(B) $GeCl_4$

(C) O_2

(D) B_2O_3

20. A particular fiber has a Fresnel reflection magnitude of 0.176. Find the power loss between the source and the fiber.

(A) 0.84 dB

(B) 0.79 dB

(C) 0.86 dB

(D) 0.80 dB

21. Raman scattering is a :

(A) Linear effect

(B) Nonlinear effect

(C) Bending loss

(D) Connector loss

22. Which equation is used to calculate MFD ?

(A) Maxwell's equations

(B) Peterman equations

(C) Allen Cahn equations

(D) Boltzmann's equations

23. The bending loss increases when :

(A) Bend radius increases

(B) Bend radius decreases

(C) NA increases

(D) Length increases

24. What is the main requirement with the fibers that are intended for splicing ?

(A) Smooth and oval end faces

(B) Rough edge faces

(C) Smooth and square end faces

(D) Large core diameter

25. A certain optical fiber has the following parameters : core radius of 4 μm, core and cladding refractive indices of 1.45 and 1.44 respectively, and operating λ of 1064 nm. V-number of the fiber is :

(A) 2.405

(B) 1.81

(C) 3.11

(D) 3.50

26. Stimulated Brillouin scattering is mainly a/an :

(A) Forward process
(B) Upward process
(C) Backward process
(D) Downward process

27. …… converts the received optical signal into an electrical signal.

(A) Detector
(B) Attenuator
(C) Laser
(D) LED

28. Core diameter of single-mode fiber is typically :

(A) 50 μm
(B) 62.5 μm
(C) 8–10 μm
(D) 100 μm

29. The most common detector in optical communication is :

(A) Zener diode
(B) Photodiode
(C) Tunnel diode
(D) Varactor diode

30. A single mode fiber has refractive indices n_1 = 1.50, n_2 = 2.23, core diameter of 8 μm, wavelength = 1.5 μm cut-off wavelength = 1.214 μm. Find the radius of curvature.

(A) 12 mm
(B) 34 mm
(C) 22 mm
(D) 36 mm

31. The optical source used in a fiber is an injection laser with a relative spectral width $\sigma\lambda / \lambda$ of 0.0011 at a wavelength of 0.70 μm. Estimate the RMS spectral width.

(A) 1.2 nm
(B) 1.3 nm
(C) 0.77 nm
(D) 0.98 nm

32. In optical fibers, the Rayleigh scattering is proportional to :

(A) $\frac{1}{\lambda}$
(B) $\frac{1}{\lambda^2}$
(C) $\frac{1}{\lambda^3}$
(D) $\frac{1}{\lambda^4}$

33. The best fiber for long-distance communication is :

(A) Plastic fiber
(B) Step-index multimode
(C) Graded index multimode
(D) Single mode fiber

34. Which of the following is not a strength member used in optical cable ?

(A) Steel wire
(B) Germanium
(C) Aramid yarns
(D) Glass elements

35. Light is guided within the core of a step-index fiber by :

(A) refraction at the core-air interface

(B) total internal reflection at core-cladding interface

(C) total internal reflection at the outer surface of the cladding

(D) change in the speed of light within the core

36. Threshold current is related to :

(A) LED

(B) Laser diode

(C) Fiber

(D) Connector

37. Fiber attenuation is minimum at :

(A) 850 nm

(B) 1310 nm

(C) 1550 nm

(D) 650 nm

38. The numerical aperture for a step index fiber is sine angle of the …… .

(A) Attenuation

(B) Acceptance angle

(C) Aperture

(D) Efficient angle

39. PIN photodiode has :

(A) No intrinsic layer

(B) Intrinsic layer

(C) Magnetic layer

(D) Copper core

40. A GaAs optical source having a refractive index of 3.2 is coupled to a silica fiber having a refractive index of 1.42. Determine Fresnel reflection at interface in terms of percentage :

(A) 17.6%

(B) 17.4%

(C) 14.8%

(D) 13.4%

41. Graded-index fibers reduce :

(A) Attenuation

(B) Pulse dispersion

(C) Signal power

(D) Bandwidth

42. …….. are formed by sandwiching the butted fiber ends between a V-groove glass substrate and a flat glass retainer plate.

(A) Springroove splices

(B) V-groove splices

(C) Elastic splices

(D) Fusion splices

43. What does ISI stand for in optical fiber communication ?

(A) Invisible size interference

(B) Infrared size interference

(C) Inter-symbol interference

(D) Inter-shape interference

44. Optical amplifier can be used as :

(A) In line amplifiers to compensate loss

(B) Power amplifier to follow the trasmitter

(C) Pre-amplifier

(D) All of the above

45. A permanent joint formed between two different optical fibers in the field is known as a …… .

(A) Fiber attenuator

(B) Fiber connector

(C) Fiber splice

(D) Fiber dispersion

46. A semiconductor laser crystal of length 5 cm, refractive index 1.8 is used as an optical source. Determine the frequency separation of the modes :

(A) 2.8 GHz

(B) 1.6 GHz

(C) 1.2 GHz

(D) 2 GHz

47. The fraction of incident photons generated by photodiode of electrons generated collected at detector is known as …… .

(A) Quantum efficiency

(B) Absorption coefficient

(C) Responsivity

(D) Anger recombination

48. In a step index fiber, what is the cut-off frequency of the LP_{11} mode ?

(A) zero

(B) 3.832

(C) 2.405

(D) 5.520

49. A …….. is created by hetero-junction at collector-base junction.

(A) Potential barrier

(B) Depletion region

(C) Electric field

(D) Inductance

50. The quantum efficiency of photodiode is 40% with wavelength of $0.90*10^{-6}$. Determine the responsivity of photodiodes.

(A) 0.22

(B) 0.50

(C) 0.29

(D) 0.51

51. Which of the following does not explain the requirements of an optical detector ?

(A) High quantum efficiency

(B) Low bias voltages

(C) Small size

(D) Low fidelity

52. Which of the following is not a part of a typical optical fiber ?

(A) Jacket

(B) Cladding

(C) Core

(D) Photodiode

53. The …… at emitter-base junction gives good emitter base injection efficiency.

(A) Homo-junction

(B) Depletion layer

(C) Hetero-junction

(D) Holes

54. Material dispersion occurs because :

(A) Different modes travel different paths

(B) Refractive index varies with wavelength

(C) Fiber bends

(D) Scattering occurs

55. …….. in the laser occurs when photon colliding with an excited atom causes the stimulated emission of a second photon.

(A) Light amplification

(B) Attenuation

(C) Dispersion

(D) Population inversion

56. MCVD stands for :

(A) Mechanical Core Vapor Deposition

(B) Modified Chemical Vapor Deposition

(C) Multi-Core Vapor Development

(D) Metal Coated Vacuum Deposition

57. The V-number determines :

(A) Loss

(B) Number of modes

(C) Power

(D) Speed

58. Coherent light has :

(A) Random phase

(B) Fixed phase relation

(C) Different wavelengths

(D) Low intensity

59. …….. technique is method of preparing extremely pure optical glasses.

(A) Direct melting Method
(B) Radio frequency induction
(C) Vapor Phase Deposition (VPD)
(D) None of the above

60. Single mode fiber eliminates :

(A) Material dispersion
(B) Chromatic dispersion
(C) Modal dispersion
(D) Scattering

61. The cable is normally covered with an outer plastic sheath to reduce ……. .

(A) Abrasion
(B) Attenuation
(C) Friction
(D) Dispersion

62. PMMA stands for :

(A) Polymethyl methacrylate
(B) Polymer methacrylate
(C) Poly methacrylate
(D) None of the above

63. Which amplifier is widely used in long-distance optical communication systems ?

(A) Semiconductor optical amplifier
(B) Raman amplifier
(C) Erbium-doped fiber amplifier (EDFA)
(D) Parametric amplifier

64. Optical fiber sensors primarily work on the principle of change in :

(A) Electrical resistance
(B) Magnetic flux
(C) Optical intensity, phase or wavelength
(D) Capacitance

65. Which process gives the laser its special properties as an optical source ?

(A) Stimulated absorption
(B) Spontaneous emission
(C) Stimulated emission
(D) None of the above

66. What is the unit of normalized frequency ?

(A) Hertz
(B) Meter/sec
(C) Coulombs
(D) It is a dimensionless quantity

67. The incident optical power required to achieve a desirable SNR is 168.2 nW. What is the value of incident power in dBm ?

(A) – 37.7 dBm
(B) – 35 dBm
(C) – 34 dBm
(D) – 38.2 dBm

68. The ring and star topologies are combined in a combined in a ……..…. configuration.

(A) Fringe

(B) Mesh

(C) Data

(D) Singular

69. Absorption losses due to atomic defects mainly include …… .

(A) Radiation

(B) Impurities in fiber material

(C) Missing molecules, oxygen defects in glass

(D) Interaction with other components of core

70. In the …….. topology, the data generally circulates bi-directionally.

(A) Mesh

(B) Bus

(C) Star

(D) Ring

71. Which of the following pairs are suitable for making a heterojunction ?

(A) Si and Ge

(B) Si and GaAs

(C) GaAs and AlAs

(D) GaAs and GaAlAs

72. Fiber Bragg Gratings cannot be used for the following measurement :

(A) Pressure

(B) Temperature

(C) Strain

(D) Liquid level

73. A measure of amount of optical fiber emitted from source that can be coupled into a fiber is termed as ……. .

(A) Coupling efficiency

(B) Angular power distribution

(C) Radiance

(D) Power-launching

74. Losses in photonic crystal fibers are reduced to a level of ……. .

(A) 0.1 dB/km

(B) 0.2 dB/km

(C) 0.3 dB/km

(D) 0.4 dB/km

75. What is the use of interposed optics in expanded beam connectors ?

(A) For index-matching

(B) To make a fiber loss free

(C) To make a fiber dispersive

(D) To achieve lateral alignment less critical than a butt-joined fiber connector

76. For a GaAs LED, the coupling efficiency is 0.05. Compute the optical loss in decibels :

(A) 11.3 dB

(B) 12 dB

(C) 13.01 dB

(D) 16.6 dB

77. The device which is used to perform wavelength conversion is called as :

(A) Wavelength translator

(B) Wavelength circulator

(C) Attenuator

(D) None of the above

78. Which are the two main sources of noise in photodiodes without internal gain ?

(A) Dark current noise and quantum noise

(B) Internal noise and external noise

(C) Gaussian noise and dark current noise

(D) Gaussian noise and quantum noise

79. The propagation constant is represented by :

(A) α

(B) β

(C) γ

(D) δ

80. …… refers to the process whereby a node finds one or more paths to possible destinations in a network.

(A) Routing

(B) Framing

(C) Lightning

(D) Cloning

81. For a given guided mode, the normalized propagation constant lies between :

(A) 0 and ∞

(B) $-\infty$ and ∞

(C) 0 and 1

(D) –1 and 1

82. Optical isolator works on :

(A) Faraday effect

(B) Hall effect

(C) Doppler effect

(D) Photoelectric effect

83. An optical time-domain reflectometer used to find …… .

(A) Cable fault position

(B) Cable length

(C) Both (A) and (B)

(D) None of the above

84. The long cutoff wavelength of GaAs is 0.923 um. Determine bandgap energy :

(A) $1.47*10^{-7}$

(B) $4.25*10^{-14}$

(C) $2.78*10^{-9}$

(D) $2.15*10^{-19}$

85. VAD is preferred for :

(A) Large-scale fiber production

(B) Producing small quantities of optical fibers

(C) Producing high-loss optical fibers

(D) Manufacturing plastic fibers

86. If a photodiode requires incident optical power of 0.70 A/W. Determine photocurrent.

(A) 1.48

(B) 2.45

(C) 4.12

(D) 3.19

87. The lower energy level contains more atoms than upper level under the conditions of …….. .

(A) Isothermal packaging

(B) Population inversion

(C) Thermal equilibrium

(D) Pumping

88. The He-Ne laser emits the following wavelength :

(A) 0.6943 μm

(B) 1.066 μm

(C) 0.6328 μm

(D) 10.6 μm

89. Sampling rate for each speech channel on 32-channel PCM is 8 kHz each encoded into 8 bits. Determine the number of bits in a frame.

(A) 256

(B) 128

(C) 32

(D) 512

90. Which of the following is NOT a characteristic of LEDs used in optical fiber communication ?

(A) Wide spectral width

(B) Low power output

(C) High coherence

(D) Low cost

91. The data rate of the SONET frame is around …….. .

(A) 50.122 Mbps

(B) 60.122 Mbps

(C) 70.122 Mbps

(D) None of the above

92. In a birefringent crystal :

(A) the o ray follows Snell's law but e ray does not
(B) the e ray follows Snell's law but o ray does not
(C) Both o ray and e ray follows Snell's law
(D) Both o ray and e ray do not follow Snell's law

93. A particular fiber has a Fresnel reflection magnitude of 0.176. Find the power loss between the source and the fiber.

(A) 0.86 dB
(B) 0.78 dB
(C) 0.84 dB
(D) 0.83 dB

94. The maximum number of TE modes supported by symmetrical SI planer waveguide is an integer greater than :

(A) $2V/\pi$
(B) V/π
(C) V
(D) zero

95. The incident optical power required to achieve a desirable SNR is 168.2 nW. What is the value of incident power in dBm ?

(A) – 37.7 dBm
(B) – 35 dBm
(C) – 34 dBm
(D) – 38.2 dBm

96. How many mechanisms are there which cause absorption ?

(A) Three
(B) One
(C) Two
(D) Four

97. The device which is used to perform wavelength conversion is called as ……. .

(A) Wavelength translator
(B) Wavelength circulator
(C) Attenuator
(D) None of the above

98. What is the standard form of SDH ?

(A) Single Digital Hierarchy
(B) Synchronous Digital Hierarchy
(C) Asynchronous Digital Hierarchy
(D) None of the above

99. Photonic crystal fibers are also called as :

(A) Conventional fibers
(B) Dotted fibers
(C) Stripped fibers
(D) Holey fibers

100. In transverse electric waves, which of the following is true ?

(A) E is parallel to H
(B) E is parallel to wave direction
(C) E is transverse to wave direction
(D) H is transverse to wave direction

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।