Assistant Director of Technical Educaton_4_2021

ADT/21

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE ASKED TO DO SO.

2021

TEST BOOKLET

TEST BOOKLET SERIES

A

Time allowed : 1½ hours

Full marks : 100

Answer ***all*** the questions.

Questions are of equal value.

Serial No. 2500121 ..... ***Roll No.:***

Signature of the Candidate:

INSTRUCTIONS

Candidates should read the following instructions carefully before answering the questions:

1. This booklet consists of 16 pages including this front page, containing 100 questions. **Verify the Page Nos. and Test Booklet series on each page and bring at once to the Invigilator's notice any discrepancy.**
2. Answers will have to be given in the Special Answer-Sheet supplied for the purpose.
3. Before you proceed to mark in the Answer-Sheet in response to various items in the Test Booklet, you have to fill in some particulars in the Answer-Sheet as per instructions sent to you in the Admit Card. ***Do not fold the Answer-Sheet as this will result in error in your marks.***
4. All questions are of multiple-choice answer-type. You will find ***four*** probable answers **(A)**, **(B)**, **(C)** and **(D)** against each question. Find out which of the four answers appears to be **correct or the best**. Now darken the circle corresponding to the letter of the selected answer in the Answer-Sheet with **Black Ball Point Pen** as per instructions printed on the reverse of the Admit Card and in the Answer-Sheet.
5. One and only one circle is to be fully blackened for answer. Any spot in any other circle (multiple circle) or in wrong circle will be considered as wrong answer.
6. ***There will be negative marking for wrong answer. 0.25 mark will be deducted for each wrong answer.***
7. ***There are blank pages at the end of this Booklet for Rough Work.***
8. ***The Special Answer-Sheet should be handed over to the Invigilator before leaving the Examination Hall. You are permitted to take away the used Test Booklet after completion of the examination.***

1. –1 Coulomb of electron and 1 Coulomb of proton charges sum up to a total charge of

(A) zero
(B) +2 Coulomb
(C) +1 Coulomb
(D) – 1 Coulomb

2. For three subsets A, B, C of a set X, if $A \cap B = A \cap C$ and $A \cup B = A \cup C$, then

(A) $A = B = C$
(B) $B = C$
(C) $A = C$
(D) $B = C = X$

3. A bullet, of mass 50 gm, is fired with a speed of 200 m/s. After penetrating a wooden block of thickness 2 cm, the bullet emerges with only 20% of its initial kinetic energy. The emergent speed of the bullet is approximately

(A) 49.31 m/s
(B) 54.39 m/s
(C) 89.44 m/s
(D) 65.45 m/s

4. In the sentence, the boy is 'swimming', the past participle form of 'swimming' is

(A) swim
(B) swam
(C) swimmed
(D) swum

5. The area bounded by the curve $y^2 = 12x$, and the straight lines $x = 0$ and $y = 6$ is

(A) 3 sq. unit
(B) 6 sq. unit
(C) 18 sq. unit
(D) 24 sq. unit

6. Convex lens, when used as a magnifying glass, produces

(A) real inverted image.
(B) virtual and erect image.
(C) real, erect image.
(D) blurred image.

7. In case of metals, the conduction band and valence band

(A) overlap.
(B) are separated by large band gap energy.
(C) do not exist.
(D) None of the above

8. LED can be made of

(A) Si
(B) Ge
(C) GaAs
(D) Carbon

9. The passive voice of the sentence:
"I love teaching boys." is

(A) Teaching boys loves me.
(B) Teaching boys is loved by me.
(C) Teaching boys was loved by me.
(D) I am loving teaching boys.

10. Their house is always <u>spick and span</u>.— The meaning of the underlined idiom is

(A) foolish
(B) neat and clean
(C) damaged on account of use
(D) ready and arranged

11. Choose the most appropriate option with the correct indirect speech of the direct speech provided:

The doctor says, "Ram, you must lose his weight as soon as possible."

(A) The doctor told Ram will lose weight.

(B) The doctor strongly advised Ram to lose weight as soon as possible.

(C) The doctor tells Ram must lose weight as soon as possible.

(D) None of the above

12. Change to the indirect speech by choosing the correct option below:

He said,"I am well now."

(A) He said that he is well now.

(B) He said that he was well then.

(C) He said that he was well now.

(D) He said that he has been well now.

13. For a metallic conductor, the resistance

(A) increases with increase in temperature.

(B) increases when temperature decreases.

(C) is independent of temperature.

(D) None of the above

14. _____ giving him food, he gave the beggar money.

Choose the correct option:

(A) By

(B) Besides

(C) On

(D) To

15. For making *n*-type semiconductors, Si or Ge is doped with

(A) carbon

(B) trivalent impurity like Al, B etc.

(C) pentavalent impurity like As, Sb, P etc.

(D) inert gas

16. Fusion reaction takes place between

(A) two light nuclei.

(B) two very heavy nuclei.

(C) one heavy and one super heavy nuclei.

(D) at least fifteen nuclei of different types.

17. A light bulb is rated at 100 W for a 220 V ac supply. The resistance of the bulb is

(A) 100 Ω

(B) 484 Ω

(C) 220 Ω

(D) 225 Ω

18. An appropriate synonym of 'pretend' is

(A) hide

(B) counterfeit

(C) conceal

(D) deceive

19. The value of i^{2025}, where $i = \sqrt{-1}$, is

(A) -1

(B) 1

(C) i

(D) $-i$

20. If z be a complex number and $|z-3| \leq 3$, then the greatest value of $|z|$ is

(A) 1

(B) 3

(C) 5

(D) 6

21. The word 'empirical' is closely connected with the word

(A) empathy
(B) emotion
(C) experience
(D) empire

22. Choose the most appropriate option with the correct indirect speech of the direct speech provided:

"All men are born free : just not for long." said the Chancellor at the Convocation.

(A) The Chancellor told at the Convocation that all men were born free, just not for long.
(B) The Chancellor said at the Convocation that all men were born free, just not for long.
(C) The Chancellor said at the Convocation that all men are being born free, just not for long.
(D) The Chancellor said at the Convocation that all men are born free, just not for long.

23. The vector, which makes an equal angle with the coordinate axes is

(A) $\frac{1}{\sqrt{3}}\left(\hat{i}-\hat{j}+\hat{k}\right)$
(B) $\frac{1}{\sqrt{2}}\left(\hat{i}+\hat{j}-\hat{k}\right)$
(C) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}\right)$
(D) $\frac{1}{\sqrt{3}}\left(\hat{i}+\hat{j}+\hat{k}\right)$

24. 'Up the wall' is an idiomatic phrase which means

(A) climb up the wall.
(B) cross over.
(C) furious or crazy.
(D) be proud of oneself.

25. Pick out the correct sentence from the given options:

(A) He as well as his brothers were invited to tea.
(B) He as well as his brothers was invited to tea.
(C) He as well as his brothers have invited to tea.
(D) He as well as his brothers are invited to tea.

26. Man profits _____ experience.

(A) in
(B) by
(C) through
(D) over

27. The current vs. voltage (I–V) characteristics of a pn junction diode

(A) is linear and follows Ohm's law.
(B) is non-linear.
(C) does not exist.
(D) None of the above

28. An electric motor operating at 220 V draws a current of 5A at its full speed. The armature resistance is 10 Ω. The efficiency of the motor is approximately

(A) 50%
(B) 22%
(C) 77.27%
(D) 85.34%

29. The point on the first quadrant on the parabola $x^2 = 8y$ whose distance from the focus is 4 unit is

(A) (2, 4)

(B) (4, 2)

(C) (0, 2)

(D) (2, 0)

30. The value of $\int_0^{\pi} \sin^3 x \cos^3 x \, dx$ is

(A) 0

(B) 1

(C) $\frac{\pi}{2}$

(D) $\frac{3\pi}{2}$

31. The antonym of 'intentional' is

(A) planned

(B) ignorance

(C) accidental

(D) constant

32. Change the direct speech by choosing the correct option below:

John says,"The teacher is not at home."

(A) John says that the teacher was not at home.

(B) John says that the teacher were not at home.

(C) John says that the teacher is not at home.

(D) John says that the teacher has not been at home.

33. If $a + b + c = 0$, then one of the roots of the equation $\begin{vmatrix} a-x & b & c \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$ is

(A) 0

(B) 1

(C) abc

(D) $a^2 + b^2 + c^2$

34. Anup is a prince _____ disguise.

(A) of

(B) in

(C) about

(D) into

35. Choose the most appropriate option with the correct passive voice:

The teacher explains the lesson to the students.

(A) The lesson is explained to the students by the teacher.

(B) The lesson is explaining to the students by the teacher.

(C) The lesson is being explained to the students by the teacher.

(D) None of the above

36. If $\lim_{x\to\infty}\left(1+\frac{1}{x}\right)^x = e$, then the value of $\lim_{x\to\infty}\left(1+\frac{1}{2x}\right)^x$ is

(A) e

(B) $\sqrt{e}$

(C) e^2

(D) $e^{3/2}$

37. If $f(x)=\begin{cases}\dfrac{1-\cos mx}{x\sin x}, & \text{when } x\neq 0\\ 2, & \text{when } x=0,\end{cases}$

is continuous at $x=0$, then the value of m is equal to

(A) 0

(B) ± 1

(C) ± 2

(D) $\pm\frac{1}{2}$

38. Choose the most appropriate option with the correct passive voice:

She wrote a letter.

(A) A letter was being written by her.

(B) A letter was to be written by her.

(C) A letter was written by her.

(D) A letter wrote she.

39. This custom is peculiar _____ India. Choose the correct option:

(A) on

(B) of

(C) to

(D) for

40. Photoelectric effect can be explained on the basis of

(A) particle nature of light.

(B) wave nature of light.

(C) rectilinear propagation of light.

(D) simple harmonic motion.

41. The internal energy of a system is defined by using

(A) the law of equipartition of energy.

(B) Newton's laws of motion.

(C) Planck's law.

(D) the first law of thermodynamics.

42. The values of k, for which the roots of the equation $9x^2 - kx + 16 = 0$ are equal are

(A) ± 24

(B) ± 25

(C) ± 12

(D) $\pm\frac{4}{3}$

43. The magnitude of the force $\vec{F}=6\hat{i}+2\hat{j}+10\hat{k}$ units is approximately

(A) 16.23 units

(B) 10 units

(C) 11.83 units

(D) 6.20 units

44. Light can propagate through optical fibre due to

(A) total internal reflection

(B) reflection

(C) transmission

(D) deviation

45. In case of intrinsic semiconductors the no. of holes is

(A) always greater than the no. of free electrons.

(B) always less than the no. of free electrons.

(C) equal to the no. of free electrons.

(D) independent of the no. of free electrons.

46. If $y=\left[(\tan x)^{\tan x}\right]^{\tan x}$, then the value of $\frac{dy}{dx}$ at $x=\frac{\pi}{4}$ is

(A) 0

(B) 1

(C) 2

(D) $2\sqrt{2}$

47. If $\frac{dy}{dx}=\frac{xy+y}{xy+x}$, then the general solution of the differential equation is

(A) $y=xe^x+c$

(B) $y=e^x+c$

(C) $y=x+c$

(D) $y=cxe^{x-y}$

48. The degree and order of the differential equation $\frac{d^2y}{dx^2}+\left[1+\left(\frac{dy}{dx}\right)^2\right]^{3/2}=0$ are

(A) 2, 3

(B) 2, 2

(C) 2, $\frac{3}{2}$

(D) 1, 2

49. A charge 'q' is moving in a uniform electric field (E). The force experienced by the charge is

(A) qE^2

(B) 0

(C) q^2E

(D) qE

50. In case of simple harmonic motion, the restoring force is

(A) proportional to time.

(B) proportional to the displacement of the particle from its mean position and directed towards the mean position.

(C) constant.

(D) inversely proportional to time.

51. A magnet having magnetic dipole moment of 1.05×10^4 J/T is free to rotate in a horizontal plane. The amount of work done in rotating the magnet from a direction parallel to an external magnetic field of 4.2×10^{-5}T to a direction making an angle of 60° with respect to the external magnetic field is approximately

(A) 1.05 J

(B) 0.22 J

(C) 0.425 J

(D) 100 J

52. The length of a simple pendulum which ticks seconds is approximately

(A) 0.25 m

(B) 0.37 m

(C) 0.50 m

(D) 1 m

53. The value of $\int_{-2}^{3}|1-x^2|\,dx$ is

(A) $\frac{1}{3}$

(B) $\frac{7}{3}$

(C) $\frac{14}{3}$

(D) $\frac{28}{3}$

54. The meaning of the idiom in the sentence: "His proposal was rejected with one voice", is

(A) thoroughly
(B) singly
(C) unanimously
(D) eventually

55. A wave travelling in a particular direction is described by

$$y(x,t) = 0.008\sin(50.0x - 5.0t)$$

where the numerical constants are in S.I. units (0.008m, 50.0 rad m^{-1} and 5.0 rad s^{-1}). The wavelength of this wave is approximately

(A) 12.56 cm
(B) 50 m
(C) 5.8 m
(D) 8.51 mm

56. The man travelled _____ the name of Colonel Verma.

(A) with
(B) under
(C) by
(D) in

57. If the variance of first n even natural numbers is 65, then n equals to

(A) 12
(B) 14
(C) 16
(D) 18

58. A piece of copper and another germanium are cooled from room temperature (300 K) to 100 K. The resistance of

(A) copper strip decreases and that of germanium increases.
(B) both copper and germanium decrease.
(C) both of the strips increase.
(D) copper strip increases and that of germanium decreases.

59. When forward bias is applied to a p-n junction, it

(A) raises the potential barrier.
(B) lowers the potential barrier.
(C) does not affect the potential barrier.
(D) None of the above

60. The electric polarisation of a dielectric medium is

(A) dependent on applied electric field.
(B) independent of applied electric field.
(C) always constant.
(D) described by Ohm's law.

61. If a, b, c be three different real numbers and they are in G.P. If $a + b + c = xb$, then x satisfies

(A) $x \neq 1$
(B) $x < -1$ and $x > 3$
(C) $x < -1$ or $x > 3$
(D) $x < -1$ and $x < 3$

62. In case of stars, the source of energy is

(A) fusion of hydrogen nuclei and subsequent reactions.
(B) fusion of lead nuclei.
(C) fission of $^{235}_{92}U$.
(D) fission over $^{238}_{92}U$.

63. The meaning of amphibious is

(A) of animal feeding on flesh.
(B) persons living at the same time.
(C) capable of living both on land and in water.
(D) liable to be called to account.

64. A dc voltage is applied to the primary of a transformer. The steady state output voltage at the secondary is

(A) zero.

(B) twice the applied dc voltage.

(C) constantly varying with time.

(D) same as the input ac voltage.

65. The range of the function $f(x) = \frac{1}{2 - \cos 3x}$ is

(A) $[-1, 1]$

(B) $\left[-1, \frac{1}{3}\right]$

(C) $\left[\frac{1}{3}, 1\right]$

(D) $[1, \infty]$

66. In case of photoelectric effect, for a given photosensitive material and frequency of incident radiation (above the threshold frequency), the photocurrent is

(A) directly proportional to the intensity of the incident light.

(B) inversely proportional to the intensity of the incident light.

(C) independent of the intensity of the incident light.

(D) directly proportional to the square of the intensity of the incident light.

67. In case of an isothermal process the transfer of heat into or out of the system happens

(A) very slowly.

(B) very fast.

(C) transfer of heat cannot take place.

(D) None of the above

68. The antonym of 'savage' is

(A) rugged

(B) civilized

(C) kind

(D) domesticated

69. The function $f(x) = \frac{1}{1 + |x|}$

(A) is differentiable at all real x.

(B) is differentiable at all real x, except ± 1.

(C) is differentiable at all real x, except 0.

(D) is nowhere differentiable.

70. According to Bohr's atomic model, an electron can revolve around the nucleus only in those orbits for which the angular momentum of the electron is

(A) zero.

(B) some integral multiple of $\frac{h}{2\pi}$, h is Planck constant.

(C) some integral multiple of R_H, R_H is Rydberg constant.

(D) $\frac{h}{R_H}$.

71. The number of ways in which 6 men and 5 women can dine at a round table, if no two women are to sit together, is given by

(A) $5! \times 6!$

(B) $5! \times 4!$

(C) 30

(D) $7! \times 5!$

72. The sum of the kinetic energy and potential energy of a particle, executing simple harmonic oscillation, is

(A) constant or independent of time.
(B) varying with time linearly.
(C) increasing exponentially with time.
(D) decreasing exponentially with time.

73. In an atom, the valence electron jumps from the ground state to the first excited state by absorbing a photon of wavelength 780 nm. The energy separation between the ground state and first excited state is [assume speed of light $c = 3 \times 10^8$ m/s] approximately
(Given $h = 6.626 \times 10^{-34}$ Js)

(A) 3.1 eV
(B) 1.59 eV
(C) 2.07 eV
(D) 0.73 eV

74. The value of $\tan^{-1}\frac{x}{y} - \tan^{-1}\left(\frac{x-y}{x+y}\right)$ is

(A) 0
(B) π
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{4}$

75. If $|\vec{\alpha}| = 10, |\vec{\beta}| = 1$ and $\vec{\alpha} \cdot \vec{\beta} = 6$, then the value of $|\vec{\alpha} \times \vec{\beta}|$ is

(A) 1
(B) 6
(C) 8
(D) 10

76. Two dice are thrown simultaneously. The probability of getting a total score of six is

(A) $\frac{1}{2}$
(B) $\frac{1}{18}$
(C) $\frac{1}{36}$
(D) $\frac{5}{36}$

77. The dielectric constant (k) of a medium with permittivity ε is ($\varepsilon_0 \rightarrow$permittivity of free space)

(A) $\frac{\varepsilon}{\varepsilon_0}$
(B) $\frac{1+\varepsilon}{\varepsilon_0}$
(C) $\frac{\varepsilon}{\varepsilon-\varepsilon_0}$
(D) $\frac{\varepsilon}{1+\varepsilon_0}$

78. The perpendicular distance from the origin of the straight line $3x + 4y = 5\sqrt{2}$ is

(A) 2 unit
(B) $\frac{1}{2}$ unit
(C) $\frac{1}{\sqrt{2}}$ unit
(D) $\sqrt{2}$ unit

79. Mean free path of a gas molecule

(A) is independent of the absolute temperature of the gas.
(B) depends on the absolute temperature of the gas.
(C) is always constant.
(D) is equal to Planck's constant.

80. In case of transformers, the voltage obtained across the secondary depends on the

(A) turns ratio.
(B) surroundings.
(C) Ohm's law.
(D) height of the transformer from ground.

81. The antonym of 'anterior' is

(A) posterior
(B) interior
(C) exterior
(D) superior

82. The function $f(x) = x^3 - 6x^2 + 9x + 1$ is decreasing in the interval

(A) $-\infty < x < 1$
(B) $1 < x < 3$
(C) $3 < x < \infty$
(D) $x < 1$ or $x > 3$

83. If a bag contains 6 red, 5 black and 3 green balls, then the probability of getting a red or green ball at round in a single drawn is

(A) $\frac{3}{7}$
(B) $\frac{3}{14}$
(C) $\frac{5}{14}$
(D) $\frac{9}{14}$

84. The antonym of 'spurious' is

(A) genuine
(B) enrich
(C) fresh
(D) fictitious

85. Use a suitable preposition to fill in the blank:

He won a scholarship by dint _____ hard work.

(A) in
(B) of
(C) through
(D) over

86. Transistors are

(A) two-terminal devices
(B) four-terminal devices
(C) three-terminal devices
(D) five-terminal devices

87. Point out the correct sentence from the given options:

(A) Unless you do not go to him, he will not help you.
(B) Unless you go to him, he will not help you.
(C) Unless you do go to him, he will not help you.
(D) Unless you did not go to him, he will not help you.

88. Change the affirmative sentence into an interrogative sentence:

I have done the chores on his behalf.

(A) Have you done the chores on his behalf?
(B) On his behalf who did the chores?
(C) The chores was done by whom?
(D) Who did the chores on whose behalf?

89. "Come here, please."— is an example of _____ sentence.

(A) Interrogative
(B) Imperative
(C) Exclamatory
(D) Negative

90. The equation of tangent to the curve $y = x^{3/2}$ at the origin is

(A) $x = 0$
(B) $y = 0$
(C) $x = y$
(D) $x = -y$

91. The motion of a particle of mass 'm' is governed by the expression $y = ut + \frac{1}{2}gt^2$, where 'y' is the position along 'g', 'u' is the initial speed, 'g' is the acceleration due to gravity and 't' is time. The force acting on the particle is

(A) gt
(B) mg
(C) mgt
(D) $\frac{1}{2}mg$

92. Total internal reflection of light may occur when light

(A) travels from a medium with lower refractive index to a medium of higher refractive index.
(B) travels from a medium of higher refractive index to a medium of lower refractive index.
(C) travels from a medium to another one having equal refractive indices.
(D) stops travelling.

93. An electric motor operating at 220 V draws a current of 5A at its full speed. The resistance of the armature is 10 Ω. The back e.m.f. of the motor is

(A) 170 V
(B) 100 V
(C) 50 V
(D) 220 V

94. 'To burn the candle at both ends' means to

(A) exhaust oneself
(B) very rarely
(C) speak directly
(D) make somebody feel unhappy

95. The sum of the focal distances of any point on the ellipse $9x^2 + 25y^2 = 225$ is

(A) 4
(B) 5
(C) 10
(D) 20

96. Select the negative sentence for the affirmative sentence mentioned below:

I was doubtful about the procedure of the application.

(A) I was not sure of the procedure of the application.
(B) I did not know the procedure of the application.
(C) I was not aware of the procedure of the application.
(D) I was ignorant of the procedure of the application.

97. If A, B and C are the three angles of an acute-angled triangle and $\cos(B + C - A) = 0$, $\sin(C + A - B) = \frac{\sqrt{3}}{2}$, then the value of $A + B$ is

(A) $\frac{7\pi}{12}$

(B) $\frac{5\pi}{12}$

(C) $\frac{\pi}{4}$

(D) $\frac{\pi}{3}$

98. In case of a p-n junction diode, the depletion layer is formed

(A) at the junction of p and n regions.

(B) at the middle of the p-region.

(C) at the bottom of the n-region.

(D) anywhere within the substrate.

99. Capacitors are two-terminal electrical devices that can

(A) store energy in the form of heat.

(B) store energy in the form of electrical charges.

(C) rectify ac to dc.

(D) convert dc into ac.

100. The finite is

(A) $A = \{x : x \text{ is an odd integer greater than } 100\}$

(B) $B = \{x : x \text{ is real and } -1 \leq x < 1\}$

(C) $C = \{x : x \text{ is an odd negative integer greater than } -100\}$

(D) $D = \{x : x \in (-\infty, \infty) \setminus \{0\}\}$