NATIONAL INSTITUTE OF TECHNOLOGY RAIPUR

Recruitment for the post of Technical Assistant (Mechanical Engg)

[Ref – Recruitment Notice No./NITRR/R-1/Advt./2023/161 dated 13.07.2023]

Time Allowed: 3 hours **Maximum Marks: 100**

Name of the Candidate: _____ App. No. _____

Serial Number of the Response Evaluation Sheet _____

_____ _____

Signature of Candidate Signature of Invigilator

INSTRUCTIONS TO THE CANDIDATES:

1. *This booklet consists of 15 **pages and 100 questions.** Please check that this Question Booklet does not have any missing or torn pages or items, if so, get it replaced by another Question Booklet.*

2. *You have to mark all your responses ONLY on the separate Response Sheet provided. It should not be folded or mutilated. No additional Response Sheet shall be provided.*

3. *Use only Black Ball point pen for filling all particulars of Question Booklet, Response Sheet as well **as darkening the circle** of the Response in the Response Sheet.*

4. *This Question Booklet **contains 100 Multiple Choice Questions,** and each question is followed by four alternative answer options for examples A, B, C and D out of **which only one most appropriate option is** to be chosen. You need to darken the most appropriate correct circle of the Response Sheet by black ball point pen.*

5. *For each question, darken only one circle on the Response Evaluation Sheet. If you darken more than one circle or darken a circle partially, the answer will be treated as invalid. **Cutting/ Alterations/ Corrections** are not permitted. Answers once darkened cannot be changed in the Response sheet. If you do not wish to attempt a question, leave all the circles in corresponding row blank and in such condition zero marks will be awarded for that question.*

6. *Every correct answer will be awarded **1** mark and **-0.25** will be deducted for each wrong answer. **No marks for non-attempted/invalid/cutting/alteration responses would be assigned**.*

7. *Use of **Electronic Gadgets**, Pager, Mobile Phone, Scientific Calculator etc. are strictly prohibited. Use of Unfair Means will lead to the cancellation of candidature. Do not carry any loose paper.*

8. *Blank spaces and blank pages at the end of this Booklet can be used for Rough Work.*

9. *Strictly adhere to disciplines during the course of examination and you are not permitted to leave the Examination Hall until the end of the test.*

10. *Return the Question Booklet and Response Sheet to the Invigilator after completion of examination, else your candidature treated as cancelled.*

PART- A (20 MARKS)

1. Consider the following statements about G-20
   1. The G-20 group was originally established as a platform for a Finance Ministers and Central Bank Governors to discuss the international economic and financial issues
   2. Digital public infrastructure is one of India's G-20 priorities.

   Which of the statements given above is/are correct

A. 1 only
B. 2 ONLY
C. both 1 and 2
D. none

2. Current Reserve Bank of India Governor is
A. Shaktikanta Das
B. Vimal Jalan
C. D. Subbarao
D. Nirmala Sitharaman

3. Who is the Chairman of Indian Space Research Organization (ISRO)
A. A. S. Kiran Kumar
B. S. Somanath
C. Shashi Tharoor
D. K. Sivan

4. Which of the following countries has its Own Satellite Navigation system
A. Australia
B. Canada
C. Israel
D. Japan

5. Constitution day is celebrated on which of the following date
A. 24th December
B. 26th November
C. 26th January
D. 2nd October

6. Select the synonym of the word "**COERCE**"
A. enchant
B. pressurize
C. cajole
D. leave

7. Select the most appropriate word to fill in the blank.
   His company has the_____ of producing the best cricket balls in the country.
A. opinion
B. brand
C. reputation
D. position

8. Select the most appropriate option to substitute the underlined segment in the given sentence. If no substitution is required, select No improvement.
"The workers of this textile factory demand higher wages for a long time."
A. have been demanding higher wages
B. demanded higher wages
C. No improvement
D. has demanded higher wages

9. Select the most appropriate meaning of the given idiom. 'To play ducks and drakes'
A. to use recklessly
B. to change places
C. to be friendly
D. to act cleverly

10 In this question, three statements are given followed by three conclusions numbered I II and III. Assuming the statements to be true, even if they seem to be at variance with commonly known facts, decide which of the conclusions logically follows /follow from the statements.
Statements:
Some spoons are black.
All blacks are crows.
No crow is a plate.
Conclusions:
I Some blacks are spoons.
II All crows are black.
III No plate is a crow
A. Only conclusion I follows
B. Only conclusion II follows
C. Both conclusion I and III follows
D. Both conclusions I and II follows

11. If P+Q means that P is mother of Q, P÷Q means P is the father of Q, P-Q means that P is sister of Q, then which of the following expression shows that A is the maternal grandfather of C?
A. B÷A+C
B. A-B÷C
C. A+B÷C
D. A÷B+C

12. The second number in the given number pairs is obtained by performing certain mathematical operations on the first number. The same operations are followed in all number pairs except one. Find the odd number pair.
A. 20:11
B. 6:4
C. 15:9
D. 12:7

13. Select the option that represents the correct order of the given words as they would appear in an English dictionary.
1. Expensive
2. Expedition

3. Experience
4. Expel
5. Expenditure

A. 2 4 5 1 3
B. 2 4 5 3 1
C. 5 2 1 4 3
D. 4 25 1 3

14. In the following question, select the missing number from given series.
1,22,44,67,91?

A. 116
B. 106
C. 115
D. 118

15. Two concentric circles are of radii 5 cm and 3 cm, find the length of the chord of the larger circle which touches the smaller circle.

A. 7 cm
B. 8 cm
C. 9 cm
D. 10 cm

16. A game consists of tossing a one rupee coin 3 times and noting its outcome each time. Hanif wins if all the tosses give the same result, i.e., three heads or three tails and loses otherwise. Calculate the probability that Hanif will lose the game?

A. 0.75
B.0.25
C. 0.5
D. 0.33

17. The laws of reflection holds true for

A. Convex surfaces only
B. Concave surfaces only
C. Plane mirrors only
D. All reflecting surfaces

18. At the time of a short circuit the electric current in circuit

A. vary continuously
B. does not change
C. reduces substantially
D. increases heavily

19 Which of these is an example of an e-governance website?

A. amazon.com
B. cbse.nic.in
C india.gov.in
D. brainly.gov.in

20. Which protocol is used to send an E-Mail over a network?

A. SMTP

B. POP3
C FTP
D. HTTP

PART- B (80 MARKS)

21. In Automobile cornering power (cornering stiffness) is ratio of:

A. $\frac{cornering\ force}{slip\ angle}$

B. $\frac{slip\ angle}{comering\ forcee}$

C. $\frac{cornering\ force}{pressure\ at\ centre}$

D. $\frac{pressure\ at\ centre}{cornering\ force}$

22. Which of these were or are used in automobiles to provide suspension?

A. Coil springs
B. Torsion bars
C. Leaf springs
D. All of the mentioned

23. Octane number of SI engine fuel is a measure of
A. Purity
B. Knock resistivity
C. Pollution level
D. Efficiency

24. The angle between the vertical line and the centre line of the king pin is known as
A. Toe angle
B. King pin angle
C. Caster angle
D. Camber angle

25. Castor and camber are terms associated with which of the following parts of an automobile?
A. Gears
B. Engine
C. Suspension
D. Wheels

26. Which one of the following CANNOT impart linear motion in a CNC machine?
A. Linear motor
B. Ball screw
C. Lead screw
D. Chain and sprocket

27. In a CNC machine tool, the function of an interpolator is to generate

A. signal for the lubrication pump during machining
B. error signal for tool radius compensation during machining
C. NC code from the part drawing during post processing
D. reference signal prescribing the shape of the part to be machined.

28. In modern CNC machine tools, the backlash has been eliminated by
A. preloaded ball screws
B. rack and pinion
C. ratchet and pinion
D. slider crank mechanism

29. A 'block' of information in a Numerical Control machine program means
A. one row on tape
B. a work comprising several rows on tape
C. one complete instruction
D. one complete program for a job

30. For the CNC part programming, match Group A with Group B:

Group A	Group B
1. G02	P. circular interpolation, counter clock wise
2. G03	Q. dwell
3. G04	R. circular interpolation, clock wise
4. G00	S. point to point countering

A. 2-P, 3-Q, 1-R, 4-S
B. 1-P, 3- Q, 2-R, 4-S
C. 1-P, 4-Q, 2-R, 3-S
D. 2-P, 1-Q, 3-R, 4-S

31. During the execution of a CNC part program block NO20 GO2 X45.0 Y25.0 R5.0 the type of tool motion will be
A. circular Interpolation-clockwise
B. circular Interpolation-counter clockwise
C. linear Interpolation
D. rapid feed

32. The binding material used in cemented carbide cutting tools is
A. Graphite
B. Tungsten
C. Nickel
D. Cobalt

33. During normalizing process of steel, the specimen is heated
A. Between the upper and lower critical temperature and cooled in still air.
B. Above the upper critical temperature and cooled in furnace.

C. Above the upper critical temperature and cooled in still air.
D. Between the upper and lower critical temperature and cooled in furnace.

34. The process of reheating the martensitic steel to reduce its brittleness without any significant loss in its hardness is
A. normalising
B. annealing
C. quenching
D. tempering

35. For a metal alloy, which one of the following descriptions relates to the stress-relief annealing process?
A. Heating the workpiece material above its recrystallization temperature, soaking and then cooling in still air.
B. Heating the workpiece material below its recrystallization temperature, holding for some time and then furnace cooling.
C. Heating the workpiece material up to its recrystallization temperature and then rapid cooling.
D. Heating the workpiece up to its recrystallization temperature and cooling to room temperature alternately for a few cycles.

36. The crystal structure of aluminium is
A. body-centred cubic
B. face-centred cubic
C. body-centred tetragonal
D. close-packed hexagonal

37. In order to determine the effects of a force acting on a body we must know
A. Magnitude and direction of the line along which it acts
B. Its nature (whether push or pull)
C. Point through which it acts on a body
D. All of these

38. The resultant of forces P and Q acting at an angle q is equal to
A. $(P^2 + Q^2 + 2PQ \sin q)^{1/2}$
B. $(P^2 + Q^2 + 2PQ \cos q)^{1/2}$
C. $(P^2 + Q^2 - 2PQ \sin q)^{1/2}$
D. $(P^2 + Q^2 - 2PQ \cos q)^{1/2}$

39. In a compound levers, the leverages of all simple lever if
A. added
B. subtracted
C. multiplied
D. divided

40. If the sum of all forces acting on a body is zero, then the body may be in equilibrium provided the forces are
A. concurrent
B. parallel

C. perpendicular
D. none of these

41. Newton's law of viscosity states that shear stress is directly proportional to
A. velocity
B. velocity gradient
C. shear strain
D. viscosity

42. Dynamic viscosity has dimensions as
A.MLT^{-2}
B. $ML^{-1}T^{-1}$
C. $ML^{-1}T^{-2}$
D. $M^{-1}L^{-1}T^{-1}$

43. Pascal's law states that pressure at a point in all directions is equal in
A. only liquid at rest
B. a fluid at rest
C. laminar flow
D. a turbulent flow

44. Atmospheric pressure held in terms of water column in
A.7.5 m
B. 8.5 m
C. 9.81 m
D. 10.3 m

45. For the laminar flow through a circular pipe
A. maximum velocity is equal to 1.5 times the average velocity
B. maximum velocity is equal to 2 times the average velocity
C. maximum velocity is equal to 2.5 times the average velocity
D. none of the above

46. The velocity distribution in a laminar flow through a circular pipe follows
A. parabolic law
B. linear law
C. logarithmic law
D. none of the above

47. When the fluid if flowing through a horizontal hot tube with a radial temperature distribution, the mechanism of heart transfer is expected to be
A. natural convection
B. forced convection
C. combined natural and force convection
D. none of these

48. Fins are provided on heat transferring surface to
A. increase surface area to promote rate of heat transfer
B. increase temperature gradient to enhance heat transfer
C. increase turbulence in flow to enhance heat transfer
D. decrease the pressure drop of fluid

49 A body which partly absorbs and partly reflects but doesn't allow any radiations to pass through if called
A. specular
B. gray
C. opaque
D. white

50. The dimensionless number considers a surface tension of a fluid is
A. Grashoff number
B. Froude number
C. Weber number
D. Stanton number

51. The reciprocity theorem states that
A. $A_1F_{12} = A_2F_{21}$
B. $A_2F_{12} = A_1F_{21}$
C. $F_{12} = F_{21}$
D. $F_{12} < F_{21}$

52. Thermal diffusivity of a substance is
A. directly proportional to the thermal conductivity
B. inversely proportional to the density of substance
C. inversely proportional to the specific heat
D. all of the above

53. Paclet number is defined as
A. Nu x Pr
B. Gr x Pr
C. Re x Pr
D. St x Pr

54. An air standard diesel engine consists of
A. Two adiabatic and two isotropic processes
B. Two constant volume and two isothermal process
C. One constant pressure, one constant volume and two adiabatic process
D. One constant pressure one constant volume and two isothermal process

55 With increase in air intake temperature, CI engine efficiency
A. Decreases
B. Increases

C. Remains same
D. Increases then decreases

56. For the same value of peak temperature, peak pressure and heat rejection the correct order of thermal efficiencies of Otto cycle, diesel cycle, dual cycles is
A. Otto > Dual > Diesel
B. Diesel > Dual > Otto
C. Dual > Diesel > Otto
D. Dual= Diesel= Otto

57. Knocking tendency in a SI engine reduces with increasing
A. Compression ratio
B. Wall temperature
C. Supercharging
D. Engine speed

58. At the time of starting, idling and low speed operations, the carburetor supplies a fuel mixture that can be termed as
A. Lean
B. Leaner than stoichiometric
C. Stoichiometric
D. Rich

59. Lubricant oil in IC engines are circulated by
A. Centrifugal pump
B. Positive displacement pump
C. Roots blower
D. Natural circulation

60 . The coupling used to connect two shafts with large angular misalignment is
A. A flange coupling
B. Oldham coupling
C. Flexible bush coupling
D. A Hooke joint

61. In terms of theoretical stress concentration factor (K_t) and fatigue stress concentration factor (K_f), the notch sensitivity 'q ' is expressed as
A. $(K_t-1)/(K_f-1)$
B. $(K_t-1)/(K_f+1)$
C. $(K_t+1)/(K_f+1)$
D. $(K_f-1)/(K_t-1)$

62. A static load is mounted at center of a shaft rotating at uniform angular velocity. This shaft will be designed for
A. Maximum compressive stress
B. Maximum tensile stress
C. Maximum bending moment

D. Fatigue loading

63. The S-N curve for steel becomes asymptotic nearly at
A. 10^3 cycles
B. 10^4 cycles
C. 10^6 cycles
D. 10^9 cycles

64. Which one of the following is the most conservative fatigue failure criterion?
A Soderberg
B modified Goodman
C ASME elliptical
D Gerber

65. Stress concentration in a machine component of a ductile material is not so harmful as it is in a brittle material because
A. Ductile material has larger young modulus
B. Poisons ratio is larger in ductile material
C. Modulus of rigidity is larger in ductile materials
D. In ductile material local yielding may distribute stress concentration

66. Internal gears are manufactured by
A. Hobbing
B. Shaping with pinion cutter
C. Shaping with rack cutter
D. Milling

67. In a machining operation, if the generatrix and directrix both are straight lines, the surface obtained is
A. Cylinder
B. Helix
C. Plane
D. Surface of revolution

68. A good cutting fluid should have
A. Low thermal speed
B. High specific heat
C. High viscosity
D. High density

69. A lead screw with half nuts in a lathe, free to rotate in both directions has
A. V threads
B. With worth threads
C. Buttress threads
D. Acme threads

70. In an orthogonal cutting process the tool used has rake angle of zero degree. The measured cutting force and thrust force are 500 N and 250N respectively. The coefficient of friction between the tool and the chip is
A. 1
B. 0.33
C. 0.25
D. 0.5

71. The stress due to suddenly applied load as compared to the stress due to same load applied gradually to the same rod is
A. half
B. same
C. double
D. three times

72. If a member is subjected to an axial tensile load the plane inclined at 45^0 to the axis carries
A. minimum shear stress
B. maximum normal stress
C. maximum shear stress
D. none of the these

73. The cantilever of length *l* carries a uniformly distributed load over the entire length, the bending moment diagram will be
A. parabola with maximum ordinate at the center
B. parabola with maximum ordinate at the cantilever end
C. triangle with maximum ordinate at free end
D. triangle with maximum ordinate at cantilever end

74. The beam of uniform strength can be designed by
A. varying cross-section area alone
B. varying the moment of inertia alone
C. varying the section modulus alone
D. none of these

75. Flexural rigidity for the deflection of beams is expressed ad
A. I/E
B. E/I
C. EI
D. 1/EI

76. The greatest twisting moment which a given shaft section can resists is equal to
A. polar modulus x shear stress
B. polar modulus/shear stress
C. shear stress / polar modulus
D. none of these

77. Slenderness ratio is defined as the ratio of
A. equivalent length of the column to the minimum ratio of gyration
B. length of the column to the minimum ratio of gyration
C. length of the column to the area of cross-section
D. minimum ratio of gyration to the area of cross-section

78. Which one of the following statements is TRUE?
A. The 'GO' gage controls the upper limit of a hole
B. The 'NO GO' gage controls the lower limit of a shaft
C. The 'GO' gage controls the lower limit of a hole
D. The 'NO GO gage controls the lower limit of a hole

79. In an interchangeable assembly, shafts of size $25.000^{+0.040}_{-0.010}$, mm mate with holes of size $25.000^{+0.030}_{+0.020}$mm. The maximum interference (in microns) in the assembly is

A. 40
B. 30
C. 20
D. 10

80. Match the following:

Group A	Group B	
P. Feeler gauge	I.	Radius of an object
Q. Fillet gauge	II.	Diameter within limits by comparison
R. Snap gauge	III.	Clearance or gap between components
S. Cylindrical plug gauge	IV.	Inside diameter of straight hole

A. P-III, Q-I, R-II, S-IV
B. P-III, Q-II, R-I, S-IV
C. P-IV, Q-II, R-I, S-III
D. P-IV, Q-I, R-II, S-III

81. In a shaft-hole system, the dimensions with tolerances (in mm) are as follows:
Shaft: $\varphi 20.000^{x}_{-x}$; Hole $\varphi\ 20.000^{-0.03}_{-y}$; where both x and y are positive real numbers.
Which one of the following will provide interference fit?
A. x=0.05, y=0.040
B. x=0.04, y=0.035
C. x=0.04, y=0.032
D. x =0.02, y=0.035

82. The sub-cooling in a refrigeration cycle-
A. Increases C.O.P.
B. Decreases C.O.P.
C. Does not alter C.O.P
D. None of these

83. The highest temperature during the cycle, in a vapour compression system, occurs after-
A. Condensation
B. Expansion
C. Evaporation
D. Compression

84. For summer air conditioning the relative humidity should not be less than-
A. 40%
B. 60%
C. 70%
D. 95%

85. In vapour absorption system lithium bromide is used as-
A. Lubricant
B. Cooling substance
C. Absorbent
D. Refrigerant

86. Which one of the following is CFC refrigerant?
A. R744
B. R290
C. R502
D. R718

87. Which of the following statement is true?
A. Flywheel reduces speed fluctuations during a cycle for a constant load, but flywheel does not control the mean speed of the engine, if the load changes.
B. Flywheel does not reduce speed fluctuation during a cycle for a constant load, but flywheel does not control the mean speed of the engine, if the load changes.
C. Governor controls speed fluctuations during a cycle for a constant load, but governor does not control the mean speed of the engine, if the load changes.
D. Governor controls speed fluctuations during a cycle for a constant load, and governor also controls the mean speed of the engine, if the load changes.

88. There are two points P and Q on a planar rigid body. The relative velocity between the two points
A. should always be along PQ
B. can be oriented along any direction
C. should always be perpendicular to PQ
D. should be along QP when the body undergoes pure translation

89. The minimum number of links in a single degree-of-freedom planar mechanism with both higher and lower kinematic pairs is
A. 2
B. 3
C. 4
D. 5

90. The speed of an engine varies from 210 rad/s to 190 rad/s. During the cycle the change in kinetic energy is found to be 400 Nm. The inertia of the flywheel in kg/m^2 is

A. 0.10
B. 0.20
C. 0.30
D 0.40

91. Which of the following is the basis of temperature measurement
A. Zeroth law of thermodynamics
B. First law of thermodynamics
C. Second law of thermodynamics
D. Third law of thermodynamics

92. Which of the following does not change during throttling process
A. enthalpy
B. entropy
C. volume
D. pressure

93. The efficiency of the reversible cycles depends upon
A. nature of the working substance
B. amount of working substance
C. temperatures of two reservoirs between which the cycle operates
D. type of cycles followed

94. When a system is in equilibrium, any conceivable change in entropy would be
A. maximum
B. zero
C. positive
D. negative

95. Solid, liquid and vapour phases of a pure substance exists in equilibrium at
A. saturated state
B. critical state
C. triple point
D. boiling point

96. When a real gas in throttled, change in temperature can be known from
A. law of corresponding states
B. Joule Kelvin coefficient
C. compressibility factor
D. generalized compressibility chart

97. Which one of the following statement is TRUE?
A. Both Pelton and Francis are impact turbines
B. Francis turbine is a reaction turbine and Kaplan turbine is an impact turbine
C. Francis turbine is an axial flow reaction turbine
D. Kaplan turbine is an axial flow reaction turbine

98. Which one of the following is NOT a rotating machine?
A. Centrifugal pump
B. Gear pump
C. Jet pump
D. Vane pump

99. In order to have maximum power from a Pelton turbine, the bucket speed must be
A. Equal to jet speed
B. Half of the jet speed
C. Double the jet speed
D. Independent of jet speed

100. The reheat factor (R_f) for a steam turbine is usually
A. Less than 1
B. 1 to 1.065
C. More than 2
D. 5 to 10