	Junior Manager (Electrical/Mechanical/IT/Instrumentation) in Assam Power Generation Corporation Limited (APGCL)
Name of Post:	
Advt. No.	12/2023 dated 25.04.2023
Date of Exam.	03.12.2023

JM/APGCL/ME/23

01285

TEST BOOKLET
Paper—I
(MECHANICAL ENGINEERING)

Series

A

Time Allowed : 2 Hours   **Full Marks : 100**

Read the following instructions carefully before you begin to answer the questions :

1. The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.

2. **Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**

3. All questions carry equal marks.
   The Answer-Sheet should be submitted to the Invigilator.
   Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.
   Example :
   Suppose the following question is asked :
      The capital of Bangladesh is
      (A) Chennai
      (B) London
      (C) Dhaka
      (D) Dhubri
   You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :

   Ⓐ Ⓑ Ⓒ Ⓓ

   In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :

   Ⓐ Ⓑ ● Ⓓ

   The example shown above is the only correct method of answering.

4. Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.

5. Please ensure that the Test Booklet has the required number of pages (16) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.

6. No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.

7. No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator. No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.

8. No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.

9. No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.

10. Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.

11. This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.

12. Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.

13. No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0·25 per 1 (one) mark against each wrong answer.

/7-A   **[No. of Questions : 100]**

1. The angles between two forces when the resultant is maximum and minimum respectively are

   (A) 180° and 0°

   (B) 0° and 180°

   (C) 90° and 0°

   (D) 90° and 180°

2. When a person moves out of a moving vehicle, he tends to fall forward due to the

   (A) first law of Newton's motion

   (B) law of inertia

   (C) unbalanced force

   (D) All of the above

3. A rubber ball is dropped from a height of 2 m. If there is no loss of velocity after rebounding, the ball will rise to a height of

   (A) 2 m

   (B) 3 m

   (C) 1 m

   (D) 4 m

4. The force applied on a body of mass 100 kg to produce an acceleration of 5 m/s² is

   (A) 100 N

   (B) 20 N

   (C) 500 N

   (D) None of the above

5. A simply supported beam has equal overhanging length and carries equal concentrated load W at the ends. Then the bending moment over a length between the supports

   (A) is zero

   (B) is a non-zero constant

   (C) is maximum at mid-span

   (D) varies uniformly from one support to another

6. A cantilever beam of length l carries a load W at its free end. For another cantilever of same material and same section but of twice the length, what load at the free end will cause the same maximum deflection at the free end?

   (A) $\dfrac{W}{2}$ (B) $\dfrac{W}{4}$

   (C) $\dfrac{W}{8}$ (D) $\dfrac{5W}{8}$

7. Which of the following statements is **wrong**?

   (A) The ratio of the limiting friction to the normal reaction is called coefficient of friction.

   (B) A machine whose efficiency is 100% is known as ideal machine.

   (C) The velocity ratio of a machine is the ratio of load lifted to the effort applied.

   (D) A force acting in the opposite direction to the motion of the body is called force of friction.

8. The Young's modulus of a material is 125 GPa and Poisson's ratio is 0·25. The modulus of rigidity of the material is

(A) 80 GPa

(B) 70 GPa

(C) 50 GPa

(D) 20 GPa

9. A kinematic chain consists of a chain of links

(A) with incompletely constrained motion

(B) in space with constrained motion

(C) with at least one link fixed and completely constrained motion

(D) with at least one link fixed and incompletely constrained motion

10. Two closely coiled helical springs A and B are equal in all respects but the number of turns of spring A is half that of spring B. The ratio of deflections in spring A to spring B is

(A) 2   (B) $\frac{1}{4}$

(C) $\frac{1}{2}$ (D) $\frac{1}{8}$

11. Rivets are generally specified by

(A) shank diameter

(B) thickness of plates to be joined

(C) diameter of head

(D) overall length

12. In a tensile test, when the material is stressed beyond elastic limit, the tensile strain _____ as compared to the stress.

(A) increases slowly

(B) increases more quickly

(C) decreases slowly

(D) decreases more quickly

13. The specific gravity of an oil whose specific weight is 7·85 kN/m³ is

(A) 0·6

(B) 1·2

(C) 1

(D) 0·8

14. Falling drops of water become spheres due to the property of

(A) viscosity of water

(B) surface tension of water

(C) compressibility of water

(D) capillarity of water

15. A uniform body 3 m long, 2 m wide and 1 m deep floats in water. If the depth of immersion is 0·6 m, then the weight of the body is

(A) 35·3 kN

(B) 33·5 kN

(C) 3·53 kN

(D) None of the above

16. A radial flow is one which

(A) oscillates with simple harmonic motion

(B) reciprocates in guides

(C) translates along an axis passing through the cam centre

(D) has an axis of movement displaced from the axis of rotation of cams

17. The ratio of lengths of connecting rod to crank radius in a locomotive engine is kept large to

(A) facilitate quick start of the engine

(B) achieve perfect balance

(C) minimize the effect of primary disturbing force

(D) minimize the effect of secondary disturbing force

18. With the increase in temperature, the resistance of a semiconductor

(A) remains constant

(B) increases

(C) decreases

(D) first increases and then decreases

19. Which one of the following acts as a modifier in glass-forming process?

(A) Sodium oxide

(B) Silicon dioxide

(C) Phosphorous oxide

(D) Magnesium oxide

20. In order to measure the flow with a venturi meter, it is installed in

(A) inclined line with flow upwards

(B) inclined line with flow downwards

(C) any direction and in any location

(D) horizontal direction

21. Newton's law of viscosity is a relationship between

(A) shear stress and velocity

(B) rate of shear strain and temperature

(C) shear stress and rate of shear strain

(D) pressure, velocity and temperature

22. A Pelton wheel is

(A) outward flow impulse turbine

(B) inward flow impulse turbine

(C) inward flow reaction turbine

(D) tangential flow impulse turbine

23. The runaway speed of a hydraulic turbine is the speed

(A) at which there will be no damage to the runner

(B) at which the turbine will run freely without load

(C) at full load

(D) corresponding to maximum overload permissible

24. In a reciprocating pump, air vessels are used to

(A) increase delivery head

(B) smoothen the flow

(C) reduce suction head

(D) reduce acceleration head

25. Which of the following pumps is preferred for flood control and irrigation application?

(A) Reciprocating pump

(B) Centrifugal pump

(C) Axial-flow pump

(D) Mixed-flow pump

26. When two bodies are in thermal equilibrium with a third body, they are also in thermal equilibrium with each other. This statement is called the

(A) second law of thermodynamics

(B) zeroth law of thermodynamics

(C) Kelvin-Planck law

(D) first law of thermodynamics

27. Molecular volume of any perfect gas at $600 \times 10^3 \, \text{N/m}^2$ at $27 \,^{\circ}\text{C}$ will be

(A) $4 \cdot 17 \, \text{m}^3/\text{kg mol}$

(B) $400 \, \text{m}^3/\text{kg mol}$

(C) $0 \cdot 15 \, \text{m}^3/\text{kg mol}$

(D) $41 \cdot 7 \, \text{m}^3/\text{kg mol}$

28. The main cause of irreversibility is

(A) unrestricted expansion

(B) mechanical and fluid friction

(C) heat transfer with a finite temperature difference

(D) All of the above

29. A perfect gas at $27 \,^{\circ}\text{C}$ is heated at constant pressure till its volume is doubled. The final temperature is

(A) $54 \,^{\circ}\text{C}$

(B) $327 \,^{\circ}\text{C}$

(C) $108 \,^{\circ}\text{C}$

(D) $654 \,^{\circ}\text{C}$

30. 1 kg of carbon produces _____ kg of carbon dioxide.

(A) $\dfrac{3}{7}$ (B) $\dfrac{11}{7}$

(C) $\dfrac{11}{3}$ (D) $\dfrac{4}{11}$

31. If both Stirling and Carnot cycle operate within the same temperature limit, then the efficiency of the Stirling cycle as compared to Carnot cycle

(A) is more

(B) is less

(C) is equal

(D) depends on other factors

32. The accumulation of carbon in a cylinder results in increase of

(A) clearance volume

(B) volumetric efficiency

(C) ignition time

(D) effective compression ratio

33. The term 'scavenging' is generally associated with

(A) two-stroke cycle engines

(B) high-efficiency engines

(C) aeroplane engines

(D) diesel engines

34. Which one of the following is most viscous lubricating oil?

(A) SAE 30

(B) SAE 80

(C) SAE 50

(D) SAE 70

35. The length of the imperial standard yard is

(A) 38 m

(B) 38 mm

(C) 38 inch

(D) 38 cm

36. In how many series the gauges can be provided?

(A) 5

(B) 2

(C) 3

(D) 4

37. How many faces are there in multipurpose angle plate?

(A) 50 faces

(B) 40 faces

(C) 30 faces

(D) 10 faces

38. Producer gas is obtained by

(A) carbonization of bituminous coal

(B) partial combustion of coal, coke, anthracite coal in a mixed air steam blast

(C) passing air and large amount of steam over waste coal at about 650 °C

(D) passing steam over incandescent coke

39. A material is said to be allotropic, if it has

(A) fixed structure at all temperatures

(B) different crystal structures at different temperatures

(C) atoms distributed in random pattern

(D) Any one of the above

40. Which of the following is used for nuclear energy?

(A) Niobium

(B) Thorium

(C) Uranium

(D) All of the above

41. Monel metal is an alloy of

(A) copper and chromium

(B) nickel and chromium

(C) nickel and copper

(D) nickel, chromium and iron

42. The process in which carbon and nitrogen both are absorbed by the metal surface to get hardened is known as

(A) flame hardening

(B) induction hardening

(C) carburizing

(D) cyaniding

43. The function of washer is

(A) to provide bearing area

(B) to absorb shocks and vibration

(C) to provide cushioning effect

(D) to fill up the axial gap

44. A cotter joint is used to transmit

(A) axial compressive load only

(B) axial tensile load only

(C) axial tensile or compressive load

(D) combined axial and twisting load

45. A refrigeration cycle operates between condenser temperature of 27 °C and evaporator temperature of 23 °C. The COP will be

(A) 0·2

(B) 1·2

(C) 5

(D) 6

46. For the same condenser temperature, if the evaporator temperature is lowered, then the HP of the compressor required will be

(A) same

(B) less

(C) more

(D) more/less depending upon the rating of the system

47. The actual volume of fresh charge admitted in four-stroke petrol engine is

(A) equal to stroke volume

(B) equal to stroke and clearance volume

(C) less than stroke volume

(D) more than stroke volume

48. In order to prevent knocking in SI engines, the charge away from the spark plug should have

(A) low density

(B) low temperature

(C) long ignition delay

(D) All of the above

49. The change in internal energy of a reversible process occurring in a closed system is equal to the heat transferred, if the process occurs at constant

(A) pressure

(B) volume

(C) temperature

(D) enthalpy

50. Which of the following parameters is significant to ascertain chemical equilibrium of a system?

(A) Clapeyron equation

(B) Maxwell relation

(C) Gibbs function

(D) Helmholtz function

51. The average thermal conductivities of water and air conform to the ratio

(A) 15 : 1

(B) 5 : 1

(C) 50 : 1

(D) 25 : 1

52. The tilt of the car wheels from the vertical is called

(A) caster

(B) camber

(C) slip angle

(D) steering axis inclination

53. Side members of a frame may undergo lateral bending due to

(A) side wind

(B) engine torque

(C) weight of vehicle

(D) sudden impact during collision

54. For heavy load transport, the diesel engines are preferred due to

(A) easy to start

(B) low operating cost

(C) low specific fuel consumption over a large range of load

(D) complete consumption of charge

55. Two closely coiled helical springs with stiffnesses K_1 and K_2 respectively are connected in series. The stiffness of an equivalent spring is given by

(A) $\dfrac{K_1 - K_2}{K_1 K_2}$

(B) $\dfrac{K_1 + K_2}{K_1 K_2}$

(C) $\dfrac{K_1 K_2}{K_1 + K_2}$

(D) $\dfrac{K_1 - K_2}{K_1 + K_2}$

56. Which of the following couplings is used to connect two shafts which have both lateral and angular misalignments?

(A) Oldham coupling

(B) Universal coupling

(C) Bushed pin-type coupling

(D) All of the above

57. When the speed of belt increases

(A) the power transmitted will decrease

(B) the coefficient of friction between belt and pulley decreases

(C) the coefficient of friction between belt and pulley increases

(D) the power transmitted will increase

58. The automobile radiator is a heat exchanger of

(A) parallel-flow type

(B) regenerative type

(C) cross-flow type

(D) counterflow type

59. A good refrigerant should have

(A) high specific volume and high latent heat of vapourization

(B) low COP and low freezing point

(C) high latent heat of vapourization and low freezing point

(D) high operating pressure and low freezing point

60. When the speed of the engine fluctuates continuously above and below the mean speed, the governor is said to be

(A) unstable

(B) stable

(C) hunt

(D) isochronous

61. The centrifugal casting method is used for casting articles of

(A) symmetrical shape about vertical axis

(B) symmetrical shape about horizontal axis

(C) non-ferrous metal only

(D) irregular shape

62. During peak load periods, the best method for compressor control is

(A) relief valve

(B) variable speed

(C) start-stop motor

(D) constant speed unloader

63. Hardness of a material represents its resistance to

(A) machining

(B) wear

(C) scratching

(D) local penetration

64. The instrument used to measure external and internal diameters of shafts, thickness of parts and depth of hole is

(A) depth gauge micrometer

(B) inside micrometer

(C) vernier calliper

(D) outside micrometer

65. A hardened component is to be made tough. Then which of the following heat treatments would be most suitable?

(A) Nitriding

(B) Normalizing

(C) Tempering

(D) Spherodizing

66. Photographic plates are coated with

(A) metallic silver

(B) silver nitrate

(C) silver halide

(D) calcium silicate

67. In American Standard Association (ASA) system, if the tool nomenclature is 8-6-5-5-10-15-2 mm, then the side rake angle will be

(A) 8°

(B) 6°

(C) 10°

(D) 5°

68. If the ratio of the diameter of the rivet hole to the pitch of rivet is 0·25, then the tearing efficiency of the joint is

(A) 0·5

(B) 0·75

(C) 0·25

(D) 0·87

69. Multiple thread screws

(A) increase the load lifting capacity

(B) help in easy lifting of load

(C) are used when quick motion is needed without exerting much force

(D) have self-locking facility

70. A lead screw with half nuts in a lathe, free to rotate in both directions, has

(A) V-threads

(B) Whitworth threads

(C) Buttress threads

(D) Acme threads

71. Resistance of a bolt can be increased by

(A) size of its head

(B) length

(C) shank diameter

(D) diameter of threaded portion

72. The key that transmits power through frictional resistance only is

(A) saddle key

(B) sunk key

(C) Woodruff key

(D) round key

73. Splines are used when

(A) power to be transmitted is low

(B) rotational speed is high

(C) high torque is to be produced

(D) stress concentration due to keyways is to be avoided

74. Which one of the following parts is *not* related to cotter joint?

(A) Socket

(B) Fork end

(C) Spigot

(D) Collar

75. The major cause of failure of pin in knuckle joint is likely to be caused by

(A) compression

(B) tension

(C) shear

(D) crushing

76. In ball bearings, the balls are subjected to

(A) shear stresses

(B) compressive stresses

(C) tensile stresses

(D) fatigue

77. Creep in belt drive is the result of

(A) improper crowning

(B) plasticity of belt material

(C) differential elongation of belt drive due to the difference in tension on two sides of the pulley

(D) change in the coefficient of friction due to overheating which is in operation for a sufficient period of time

78. The stroke of a shaping machine is 250 mm. It makes 30 double strokes per minute. The overall average speed of operation is

(A) 7·5 m/min

(B) 3·75 m/min

(C) 5 m/min

(D) 15 m/min

79. Which of the following statements is *wrong* about ultrasonic machining?

(A) It cuts materials at very slow speed.

(B) It produces good surface finish.

(C) It is best suited for machining hard and brittle materials.

(D) It removes large amount of materials.

80. The most effective method of controlling SI engine's exhaust emission is

(A) by using some additives in the fuel

(B) by recirculating exhaust

(C) by using catalytic converter

(D) None of the above

81. Which of the following is for environment management?

(A) ISO 14000

(B) ISO 9000

(C) ISO 6000

(D) ISO 31000

82. TQM and ISO both focus on

(A) supplier

(B) employee

(C) customer

(D) All of the above

83. Deming's four-step cycle for improvement is

(A) plan, control, act, sustain

(B) schedule, do, act, check

(C) do, act, check, monitor

(D) plan, do, check, act

84. Which of the following is *not* the advantage of CNC machines?

(A) Improved strength of the components

(B) Reduced scrap rate

(C) Higher flexibility

(D) Improved quality

85. Production of pure powder of iron and copper can be effectively done by using

(A) automization

(B) electrolysis

(C) reduction

(D) crushing

86. Which of the following processes would produce strongest components?

(A) Forging

(B) Cold rolling

(C) Extrusion

(D) Hot rolling

87. The surface roughness on a drawing is represented by

(A) square

(B) curves

(C) triangles

(D) zig-zag lines

88. A system of three forces acts on a body and keeps it in equilibrium. The forces need to be

(A) coplanar only

(B) concurrent only

(C) coplanar but may or may not be concurrent

(D) coplanar as well as concurrent

89. The ratio of moment of inertia of a rectangle and that of a triangle, having same base and height, with respect to their bases would be

(A) 3 : 1

(B) 4 : 1

(C) 6 : 1

(D) 2 : 1

90. Which of the following is desired in materials used for springs?

(A) Toughness

(B) Stiffness

(C) Resilience

(D) Elasticity

91. If W is the weight of belt/length, V is the linear velocity of belt, then stress due to centrifugal forces is given by

(A) $\dfrac{WV^2}{3g}$

(B) $\dfrac{WV^2}{g}$

(C) $\dfrac{3WV^2}{2g}$

(D) $\dfrac{2WV^2}{g}$

92. When two shafts are neither parallel nor intersecting, power can be transmitted by using

(A) a pair of spur gears

(B) a pair of helical gears

(C) an Oldham's coupling

(D) a pair of spiral gears

93. Two mating spur gears have 40 and 120 teeth respectively. The pinion rotates at 1200 r.p.m. and transmits a torque of 20 N-m. The torque transmitted by the gear is

(A) 6·6 N-m

(B) 20 N-m

(C) 40 N-m

(D) 60 N-m

94. In flow through a pipe, the transition from laminar to turbulent flow does **not** depend on

(A) diameter of the pipe

(B) length of the pipe

(C) density of the fluid

(D) velocity of the fluid

95. Which one of the following is the fluid whose properties in all its three phases are made use of thermodynamics?

(A) Freon

(B) Helium

(C) Water

(D) Ammonia

96. A setscrew is used

(A) for connecting cylinder heads in an engine

(B) for power transmission

(C) as a locking device for nuts

(D) to prevent relative motion between two parts

97. To obtain a finish cut in milling

(A) the feed is decreased and the cutting speed is increased

(B) the feed is increased and the cutting speed is decreased

(C) both the feed and cutting speeds are decreased

(D) both the feed and cutting speeds are increased

98. Which of the following factors determines the wear life of brakes?

(A) pv

(B) $\dfrac{p}{v}$

(C) pv^2

(D) p^2v

99. Bearings are designed by at least three numbers which represent the

(A) bore and width of the bearing

(B) width of the bearing

(C) series of the bearing

(D) series and bore of the bearing

100. An Allen bolt

(A) is a self-locking bolt

(B) is provided with a countersunk head

(C) has a hexagonal depression on its head

(D) has both ends threaded

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