

DO	Name of Post:	Junior Manager (Electrical/Mechanical/Civil/IT) under Assam Electricity Grid Corporation Limited (AEGCL)	JM/AEGCL/ME/23 RE ASKED TO DO SO
	Advt. No.	14/2023 dated 28.04.2023	
	Date of Exam.	26.11.2023	

Test Booklet No. :

Series



01305

TEST BOOKLET

Paper—II

(MECHANICAL ENGINEERING)

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.

/17-A

[No. of Questions : 100]

SEAL

1. Two equal forces P are acting on a point simultaneously at right angles to each other. The resultant of the forces is

(A) $2P$

(B) $\sqrt{2}P$

(C) $\frac{P}{\sqrt{2}}$

(D) $\frac{P}{2}$

2. The polar moment of inertia for area of a ring of radii r_1 and r_2 is

(A) $\pi(r_2^4 - r_1^4)$

(B) $\frac{\pi(r_2^4 - r_1^4)}{2}$

(C) $2\pi(r_2^4 - r_1^4)$

(D) $\frac{\pi(r_2^4 - r_1^4)}{4}$

3. Newton's first law of motion gives the concept of

(A) work

(B) force

(C) inertia

(D) energy

4. A system of forces acting on a body and meet at one point but their lines of action do not lie in the same plane. The forces are called

(A) coplanar concurrent forces

(B) coplanar non-concurrent forces

(C) non-coplanar concurrent forces

(D) non-coplanar non-concurrent forces

5. In simple harmonic motion, the acceleration is proportional to

(A) displacement

(B) linear velocity

(C) angular velocity

(D) energy

6. The maximum frictional force which comes into play when a body just begins to slide over the surface of the other body is known as

(A) dynamic friction

(B) static friction

(C) coefficient of friction

(D) limiting friction

7. A body of weight 15 N rests on a horizontal floor. The body just starts moving when a gradually increasing horizontal force applied on the body reaches 5 N. The coefficient of friction between the body and the floor will be

(A) 3

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

(C) $\frac{1}{5}$

(D) 5

8. The motion of a bicycle wheel is

(A) linear

(B) rotary

(C) translatory

(D) rotary as well as translatory

9. The resultant of force acting on a body will be zero, if the body

(A) rotates

(B) does not rotate

(C) moves along a curved path

(D) rotates with uniform acceleration

10. A metal bar of length 1 m and cross-sectional area 1.5 cm^2 is subjected to a pull of 15 kN. The measured elongation of the bar is found 0.5 mm. The modulus of elasticity of the material of the bar is

(A) $0.1 \times 10^6 \text{ N/mm}^2$

(B) $0.2 \times 10^6 \text{ N/mm}^2$

(C) $0.5 \times 10^6 \text{ N/mm}^2$

(D) $0.7 \times 10^6 \text{ N/mm}^2$

11. The mechanical advantage of a lifting machine is the ratio of the

(A) distance moved by effort to the distance moved by load

(B) distance moved by load to the distance moved by effort

(C) load lifted to the effort applied

(D) effort applied to the load lifted

12. The unit of moment of inertia of an area is

(A) kg-m

(B) kg-m^2

(C) kg-m^4

(D) m^4

13. The slope on the road generally provided on the curves is known as

(A) angle of repose

(B) angle of friction

(C) angle of banking

(D) angle of reaction

14. Within elastic limit, the ratio of shear stress to shear strain is known as

- (A) modulus of elasticity
- (B) bulk modulus
- (C) modulus of rigidity
- (D) Poisson's ratio

15. The strength of a beam mainly depends on

- (A) centre of gravity of the section
- (B) weight of the beam
- (C) section modulus
- (D) bending moment

16. The property of a material by virtue of which it retains permanent deformation, even when the external load causing the deformation is removed, is called

- (A) elasticity
- (B) plasticity
- (C) ductility
- (D) malleability

17. The percentage of carbon in cast iron usually varies between

- (A) 0.1% to 0.2%
- (B) 0.5% to 1.0%
- (C) 1.0% to 1.5%
- (D) 2.5% to 3.5%

18. Vibration damping in machinery is best achieved by means of base structure. The most preferred material for base structure of machinery is

- (A) stainless steel
- (B) grey cast iron
- (C) low-carbon steel
- (D) high-speed steel

19. The metal working process that plastically deforms the metal below its recrystallization temperature is called

- (A) hardening
- (B) annealing
- (C) cold working
- (D) hot working

20. 18-4-1 high-speed steel contains

- (A) 18% nickel, 4% chromium and 1% vanadium
- (B) 18% tungsten, 4% chromium and 1% vanadium
- (C) 18% tungsten, 4% nickel and 1% cobalt
- (D) 18% nickel, 4% cobalt and 1% vanadium

21. Rusting of stainless steel gets prevented to a considerable extent by alloying it with
- (A) manganese
 - (B) vanadium
 - (C) cobalt
 - (D) chromium
22. Solder, which is used for joining metal pieces, is an alloy of
- (A) tin and lead
 - (B) zinc and lead
 - (C) tin and zinc
 - (D) zinc and copper
23. The chisels and files used in a fitting shop are generally made of
- (A) cast iron
 - (B) mild steel
 - (C) high carbon steel
 - (D) forged steel
24. Toughness of a material signifies
- (A) strength
 - (B) softening
 - (C) brittleness
 - (D) fatigue resistance
25. Which is closest to the purest form of iron?
- (A) Cast iron
 - (B) Wrought iron
 - (C) Pig iron
 - (D) Steel
26. Mild steel belongs to which of the following categories?
- (A) No carbon steel
 - (B) Low-carbon steel
 - (C) Medium-carbon steel
 - (D) High-carbon steel
27. Cold worked components are generally subjected to which of the following processes to relieve stresses?
- (A) Annealing
 - (B) Austempering
 - (C) Age hardening
 - (D) Tempering
28. Maximum surface hardness is attained by
- (A) cyaniding
 - (B) carburizing
 - (C) flame hardening
 - (D) nitriding

29. The purpose of annealing is
- to increase hardness
 - to decrease machinability
 - to remove internal stress
 - for surface hardening
30. Nitriding is a process for
- annealing
 - spheroidizing
 - case hardening
 - normalizing
31. The lead of single-start thread is _____ its pitch.
- double of
 - triple of
 - equal to
 - half of
32. The purpose of levelling bolts is to
- support the load of the machine
 - adjust the height of the machine
 - provide the rigidity of the machine
 - None of the above
33. Which nut has upper portion hexagonal and lower portion cylindrical in shape?
- Swan nut
 - Castle nut
 - Grooved nut
 - None of the above
34. Rivets are made of
- brittle materials
 - soft materials
 - ductile materials
 - Any of the above
35. According to Unwin's empirical formula, the relationship between the diameter of the rivet hole (d) and the thickness of the plate (t) is given by
- $\sqrt{t} = \frac{d}{6}$
 - $t = \frac{d}{2}$
 - $t = 6\sqrt{d}$
 - $t = 2d$
36. A cotter joint is capable of transmitting
- twisting moment
 - axial tensile as well as compressive load
 - bending moment
 - only axial compressive load

37. A cotter joint is used to connect two rods which are in
- tension only
 - compression only
 - tension and compression
 - shear only
38. The type of coupling used to join two shafts whose axes are neither in same straight line nor parallel but intersect, is
- Oldham's coupling
 - universal coupling
 - flexible coupling
 - chain coupling
39. The bolts in a rigid flanged coupling connecting two shafts transmitting power are subjected to
- force and bending moment
 - pure shear
 - tension only
 - torsion and bending moment
40. If there are two springs A and B of stiffnesses K_A and K_B respectively, and if $K_A > K_B$, then on application of the same force, work done is more in
- B
 - A
 - Same in both
 - Information insufficient
41. When a closely-coiled helical spring is subjected to an axial load, it is said to be under
- shear
 - bending
 - torsion
 - tension
42. Factor of safety for ductile material subjected to static loading is the ratio of
- yield stress to working stress
 - breaking stress to working stress
 - ultimate stress to working stress
 - ultimate stress to breaking stress
43. The type of stress induced in a bolt when the nut is tightened by putting a washer beneath it, is
- crushing stress
 - shear stress
 - tensile stress
 - torsional stress
44. A flange coupling is used to connect two shafts
- whose axes are perfectly aligned
 - whose axes intersect at a small angle
 - whose axes are parallel but not aligned
 - All of the above

45. A key that transmits power through frictional resistance only is

- (A) saddle key
- (B) Woodruff key
- (C) square key
- (D) All of the above

46. The general energy equation is applicable to

- (A) steady flow
- (B) unsteady flow
- (C) turbulent flow
- (D) laminar flow

47. The equation of continuity of flow is based on the principle of conservation of

- (A) momentum
- (B) energy
- (C) mass
- (D) None of the above

48. A Pitot tube is used for the measurement of

- (A) pressure
- (B) surface tension
- (C) viscosity
- (D) velocity

49. A Rotameter is a device used to measure

- (A) vortex flow
- (B) flow of fluids
- (C) viscosity of fluids
- (D) density of fluids

50. The flow in a pipe is laminar, if the Reynolds number is

- (A) equal to 6300
- (B) equal to 10000
- (C) less than 2000
- (D) between 4000 and 6000

51. The property of a liquid which offers resistance to the movement of one layer of liquid over another adjacent layer of liquid is called

- (A) surface tension
- (B) compressibility
- (C) viscosity
- (D) capillary action

52. The pressure difference between two points in a pipe carrying a fluid can be measured by

- (A) pressure gauge
- (B) venturi meter
- (C) orifice meter
- (D) differential manometer

53. A body floating in a liquid is said to be in neutral equilibrium, if its metacentre
- coincides with the centre of gravity
 - lies above its centre of gravity
 - lies below its centre of gravity
 - lies between the centre of buoyancy and centre of gravity
54. A hot-wire anemometer is used for the measurement of
- pressure of gases
 - velocity of gases
 - viscosity of gases
 - density of liquids
55. Capillary action is due to
- viscosity of liquid
 - cohesion of liquid particles
 - surface tension
 - None of the above
56. The cavitation in a hydraulic machine occurs due to
- high inlet velocity of the liquid
 - high pressure of the liquid
 - low static pressure of the liquid that falls below its vapour pressure
 - low velocity of the liquid
57. Outward radial flow turbines
- are impulse type
 - may be impulse or reaction type
 - are reaction type
 - None of the above
58. A Pelton wheel is
- inward-flow impulse turbine
 - outward-flow impulse turbine
 - axial-flow impulse turbine
 - inward-flow reaction turbine
59. The turbine that **cannot** be installed in high head plant is
- Pelton wheel, vertical
 - Pelton wheel, horizontal
 - Francis turbine, vertical
 - Kaplan turbine
60. The atmospheric pressure held in terms of water column is
- 7.5 m
 - 8.5 m
 - 9.81 m
 - 10.30 m

61. The first law of thermodynamics refers to conservation of
- mass
 - energy
 - force
 - momentum
62. Isothermal and adiabatic processes are identical at
- saturation temperature
 - critical temperature
 - absolute zero temperature
 - below zero degree Celsius temperature
63. The SI unit of specific heat is
- J/kg-K
 - W/kg-K
 - J
 - W/m²-K
64. A thermodynamic process, in which the working substance neither receives nor gives out heat to its surrounding during expansion or compression, is called
- isothermal process
 - polytropic process
 - adiabatic process
 - isobaric process
65. The cylinder of an Otto engine has a volume (swept volume) of $6 \times 10^{-3} \text{ m}^3$. The compression ratio of the engine is 4. The clearance volume of the engine cylinder is
- $2 \times 10^{-3} \text{ m}^3$
 - $4 \times 10^{-3} \text{ m}^3$
 - $1 \times 10^{-3} \text{ m}^3$
 - $3 \times 10^{-3} \text{ m}^3$
66. The ideal Diesel cycle consists of
- two isentropic processes, a constant pressure process and a constant volume process
 - two isentropic processes and two constant volume processes
 - two isentropic processes and two constant pressure processes
 - two isentropic processes and two constant temperature processes
67. The bomb calorimeter is used for finding calorific value of
- solid fuel only
 - liquid and gaseous fuel
 - solid and liquid fuel
 - solid and gaseous fuel
68. A condenser in a steam power plant helps to
- reduce back pressure of steam
 - increase expansion ratio of steam
 - reduce temperature of exhaust steam
 - All of the above

69. In a four-stroke engine, the working cycle is completed in
- one revolution of the crankshaft
 - two revolutions of the crankshaft
 - four revolutions of the crankshaft
 - half revolution of the crankshaft
70. The knocking in CI engines occurs due to
- sudden ignition and abnormally rapid combustion of accumulated fuel in the combustion chamber
 - propagation of a high-speed pressure wave created by the auto-ignition of end portion of unburnt fuel
 - sudden increase in load condition and supply of insufficient fuel mixture to the cylinder
 - All of the above
71. The mechanical efficiency of a 4-cylinder Diesel engine is 75%. The power available in the shaft as measured by using a brake dynamometer is 12 kW. The power developed inside the engine is
- 14 kW
 - 16 kW
 - 18 kW
 - 20 kW
72. The ratio of indicated thermal efficiency to air-standard efficiency of an IC engine is called
- mechanical efficiency
 - volumetric efficiency
 - relative efficiency
 - brake thermal efficiency
73. Reheating in gas turbine
- increases the output from the turbine
 - increases the compressor work
 - decreases the thermal efficiency
 - decreases the power consumed by the compressor
74. A gas turbine works on
- Rankine cycle
 - Carnot cycle
 - Otto cycle
 - Brayton cycle
75. In a vapour-compression refrigeration system, the refrigerating effect is produced by
- condenser
 - compressor
 - evaporator
 - throttle valve
76. The method of obtaining different mechanisms by fixing in turn different links in a kinematic chain, is known as
- structure
 - machine
 - inversion
 - compound mechanism

77. If the number of links in a mechanism is equal to l , then the number of possible inversions is

- (A) $l - 2$
- (B) $l - 1$
- (C) l
- (D) $l + 1$

78. A kinematic chain is known as a mechanism when

- (A) none of the links is fixed
- (B) one of the links is fixed
- (C) two of the links are fixed
- (D) None of the above

79. The Grubler's criterion for determining the degree of freedom (n) of a mechanism having plane motion is

- (A) $n = (l - 1) - j$
- (B) $n = 2(l - 1) - 2j$
- (C) $n = 3(l - 1) - 2j$
- (D) $n = 4(l - 1) - 3j$

where j is number of joints.

80. In a kinematic chain, the minimum number of kinematic pairs required is

- (A) one
- (B) two
- (C) three
- (D) four

81. A cam and follower combination belongs to the category of

- (A) lower pair
- (B) rotating pair
- (C) screw pair
- (D) higher pair

82. When the elements in a kinematic pair have surface contact during the motion, the pair is known as

- (A) closed pair
- (B) open pair
- (C) lower pair
- (D) higher pair

83. The relation between the number of pairs (p) and the number of links (l) forming a kinematic chain is

- (A) $l = 2p - 2$
- (B) $l = 2p - 3$
- (C) $l = 2p - 4$
- (D) $l = 2p - 5$

84. The gear train where axes of gears have motion is called

- (A) simple gear train
- (B) compound gear train
- (C) epicyclic gear train
- (D) reverted gear train

85. The gears employed for connecting two non-intersecting and non-parallel, i.e., non-coplanar shafts are
- bevel gears
 - spiral gears
 - helical gears
 - mitre gears
86. In order to have a complete balance of the several revolving masses in different planes
- the resultant force must be zero
 - the resultant couple must be zero
 - both the resultant force and couple must be zero
 - None of the above
87. What is the balancing mass required to balance a mass of 5 kg at a distance of 2 cm from the axis of rotation? (Assume that balancing mass is placed opposite to the unbalanced mass and 1 cm away from the axis of rotation.)
- 5 kg
 - 10 kg
 - 15 kg
 - 0.2 kg
88. What is meant by ABS?
- Avoid Brake System
 - Actual Brake System
 - Antilock Braking System
 - Automatic Brake System
89. When brake is applied, the kinetic energy of a body is converted into
- mechanical energy
 - potential energy
 - electrical energy
 - chemical energy
90. If the shortest link is fixed, what type of mechanism is obtained?
- Double-crank mechanism
 - Double-rocker mechanism
 - Linkage is not planar
 - Crank-rocker mechanism
91. Using the Taylor's tool life equation with exponent $n = 0.5$, if the cutting velocity is reduced by half, the ratio of new tool life to original tool life is
- 0.5
 - 4
 - 2
 - 1
92. The angle between the tool face and the plane parallel to the base of the cutting tool is called
- clearance angle
 - rake angle
 - relief angle
 - shear angle

93. In resistance welding, heat is generated due to resistance between

- (A) electrode and workpiece
- (B) two dissimilar metals being in contact
- (C) interatomic forces
- (D) asperities between touching plates

94. Acetylene gas is produced from

- (A) carbon
- (B) calcium carbide
- (C) calcium chloride
- (D) calcium carbonate

95. The size of a shaper is given by

- (A) rate size
- (B) stroke length
- (C) motor power
- (D) mass of machine

96. Tapping is the operation of

- (A) cutting internal threads by means of a tap in the already drilled hole
- (B) enlarging an already drilled hole by using a rotating single-point tool
- (C) making a tapered hole in the already drilled hole
- (D) countersinking the already drilled hole

97. Break-even point refers to

- (A) more total cost than sales revenue
- (B) less total cost than sales revenue
- (C) total cost equals to sales revenue
- (D) fixed cost equals to variable cost

98. CPM and PERT techniques are used for

- (A) layout planning
- (B) financial management
- (C) executing a new project
- (D) increasing productivity

99. Production planning is essential for

- (A) inventory management
- (B) quality management
- (C) supply management
- (D) All of the above

100. Work cost is defined as

- (A) primary cost plus manufacturing costs
- (B) factory outlays
- (C) initial expense
- (D) factory price

SPACE FOR ROUGH WORK

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SEAL

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