

28/12/2025

MEJ/DRW/I/25/9

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

Test Booklet No. :

Series

TEST BOOKLET

01688

MECHANICAL ENGINEERING

Paper—I



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 :

(A) (B) (C) (D)

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 :

(A) (B) (C) (D)

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.

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[No. of Questions : 100]

SEAL

1. A device used in a boiler to control the flow of steam from the boiler to the main pipe and to shut off steam completely when required is known as

- (A) blow off cock
- (B) fusible plug
- (C) superheater
- (D) stop valve

2. A steam nozzle converts

- (A) heat energy of steam into kinetic energy
- (B) kinetic energy into heat energy of steam
- (C) heat energy of steam into potential energy
- (D) potential energy into heat energy of steam

3. Scavenging air in Diesel engine means

- (A) air used for combustion sent under pressure
- (B) air used for forcing burnt gases out of engine's cylinder during the exhaust period
- (C) forced air for cooling cylinder
- (D) burnt air containing product of compression

4. Ignition quality of Diesel fuel is expressed by an index called

- (A) cetane number
- (B) octane number
- (C) calorific value
- (D) ignition temperature

5. Petrol engine works on

- (A) Diesel cycle
- (B) Carnot cycle
- (C) Otto cycle
- (D) Rankine cycle

6. The process of supplying the intake air to engine cylinder at a pressure greater than the pressure of the surrounding atmosphere is known as

- (A) autoignition
- (B) detonation
- (C) scavenging
- (D) supercharging

7. One ton of the refrigeration is

- (A) the standard unit used in measuring water
- (B) the cooling effect produced by melting of 1 ton of ice
- (C) the refrigeration effect to freeze 1 ton of water at 0°C into ice at 0°C in 24 hours
- (D) the refrigeration effect to produce 1 ton of ice at NTP condition

8. Young's modulus of elasticity for a perfectly rigid body is

- (A) zero
- (B) unity
- (C) infinity
- (D) some finite non-zero constant

9. The pressure of fluid can be measured by
 (A) barometer
 (B) manometer
 (C) Bourdon pressure gauge
 (D) All of the above
10. One litre of water occupies a volume of
 (A) 1000 cm^3
 (B) 100 cm^3
 (C) 500 cm^3
 (D) 250 cm^3
11. Falling drops of rainwater becomes spherical due to
 (A) viscosity
 (B) cohesion
 (C) adhesion
 (D) surface tension
12. The wetted perimeter for a pipe running full of water is equal to
 (A) $\frac{\pi d}{2}$
 (B) $2\pi d$
 (C) πd
 (D) $\frac{\pi d^2}{4}$
13. The oxygen cylinder is usually painted in
 (A) black colour
 (B) white colour
 (C) maroon colour
 (D) yellow colour

14. The type of tool used on lathe, shaper and planer is
 (A) single-point cutting tool
 (B) two-point cutting tool
 (C) three-point cutting tool
 (D) multi-point cutting tool

15. Match List-I with List-II and select the correct answer using the codes given below the Lists :

List-I	List-II
[Cycle operating between fixed temperature limits]	[Characteristic of cycle efficiency]
a. Otto cycle	1. Efficiency depends only on temperature limit
b. Diesel cycle	2. Efficiency depends only on pressure limit
c. Carnot cycle	3. Efficiency depends on volume compression ratio
d. Brayton cycle	4. Efficiency depends on cut-off ratio and volume compression ratio

Codes :

- | | | | | |
|-----|---|---|---|---|
| (A) | a | b | c | d |
| | 3 | 4 | 1 | 2 |
| (B) | a | b | c | d |
| | 3 | 2 | 1 | 4 |
| (C) | a | b | c | d |
| | 1 | 4 | 3 | 2 |
| (D) | a | b | c | d |
| | 1 | 2 | 3 | 4 |

16. A closed thermodynamic system is one in which
- (A) there is no energy or mass transfer across the boundary
 - (B) there is no mass transfer but energy transfer exists
 - (C) there is no energy transfer but mass transfer exists
 - (D) both energy and mass transfer take place across the boundary but mass transfer is controlled by valves
17. First law of thermodynamics refers to conservation of
- (A) mass
 - (B) momentum
 - (C) energy
 - (D) force
18. Which of the following processes is **not** associated with Diesel cycle?
- (A) Constant volume
 - (B) Constant pressure
 - (C) Isothermal
 - (D) Adiabatic
19. Morse test can be conducted for
- (A) single-cylinder Petrol engine
 - (B) single-cylinder Diesel engine
 - (C) multi-cylinder engine
 - (D) All of the above
20. A ball and socket joint forms a
- (A) turning pair
 - (B) rolling pair
 - (C) spherical pair
 - (D) sliding pair
21. In domestic wiring, the fuse or switch is always inserted in
- (A) series with the phase of supply
 - (B) series with the neutral of supply
 - (C) parallel with the phase of supply
 - (D) series with the earthing of supply
22. Creep in a belt occurs due to
- (A) weak material of the belt
 - (B) weak material of the pulley
 - (C) improper crowning
 - (D) uneven contraction and extension of the belt
23. Which of the following machines **does not** require a flywheel?
- (A) Steam engine
 - (B) Gas turbine
 - (C) Power press
 - (D) Punching machine

24. Which one of the following pairs is **not** correctly matched?

- (A) Positive drive $\leftrightarrow$ Bell drive
- (B) High velocity ratio $\leftrightarrow$ Worm gearing
- (C) To connect non-parallel and non-intersecting shaft $\leftrightarrow$ Spiral gearing
- (D) Diminished noise and smooth operation $\leftrightarrow$ Helical gearing

25. Alloys in which mercury is one of the metals are called

- (A) emulsions
- (B) amalgams
- (C) haematics
- (D) magnalium

26. For maximum horizontal range, the angle of projection of a projectile should be

- (A) 30°
- (B) 45°
- (C) 60°
- (D) 75°

27. Four forces P , $2P$, $3P$ and $4P$ act along the sides of a square, taken in order. The resultant force is

- (A) zero
- (B) $2\sqrt{2}P$
- (C) $2P$
- (D) $\sqrt{5}P$

28. In a turbulent flow, the flow is characterized by

- (A) parallel layer with no mixing
- (B) constant velocity throughout the section
- (C) very low Reynolds number
- (D) random and chaotic motion of particle

29. The ability of a tool material to retain its hardness while working at elevated temperature is known as

- (A) toughness
- (B) hot hardness
- (C) wear resistance
- (D) None of the above

30. Which point on the stress-strain curve marks the onset of permanent deformation?

- (A) Ultimate stress
- (B) Elastic limit
- (C) Limit of proportionality
- (D) Yield point

31. Power transmitted by a shaft is directly proportional to

- (A) torque
- (B) RPM
- (C) Both (A) and (B)
- (D) diameter

32. Which of the following **does not** relate to a spark ignition engine?

- (A) Ignition coil
- (B) Distributor
- (C) Spark plug
- (D) Fuel injector

33. The firing order in a multi-cylinder engine is critical for

- (A) engine cooling
- (B) lubrication timing
- (C) even fuel distribution
- (D) engine balance and smoothness

34. Which of the following is the characteristic of force?

- (A) Direction of application of force
- (B) Magnitude of force
- (C) Point of application of force
- (D) All of the above

35. Which of the following statements about Bernoulli's equation is **incorrect**?

- (A) It is valid for incompressible, steady, frictionless flow.
- (B) It applies equally well to both ideal and real fluid.
- (C) It is based on conservation of energy principle.
- (D) It explains the relationship between pressure, velocity and elevation.

36. If the resistance in a DC circuit is doubled and the applied voltage remains constant, then what happens to the current?

- (A) It becomes half
- (B) It doubles
- (C) It remains unchanged
- (D) It becomes zero

37. In a shaping machine, the quick return mechanism is used to

- (A) increase stroke length
- (B) reduce tool wear
- (C) increase the cutting speed
- (D) reduce return stroke time

38. Second law of thermodynamics defines

- (A) heat
- (B) work
- (C) internal energy
- (D) entropy

39. A device used to increase the temperature of saturated steam without raising its pressure is called

- (A) superheater
- (B) fusible plug
- (C) blow off cock
- (D) economizer

40. One ton of refrigeration is equal to

- (A) 420 kJ/min
- (B) 210 kJ/min
- (C) 21 kJ/min
- (D) 620 kJ/min

41. During a refrigeration cycle, heat is rejected by the refrigerant in a/an

- (A) condenser
- (B) compressor
- (C) evaporator
- (D) expansion valve

42. Which type of milling operation is used for producing a flat surface perpendicular to the axis of rotation of the cutter?

- (A) End milling
- (B) Side milling
- (C) Face milling
- (D) Slot milling

43. When water is heated from the freezing point to the boiling point, then the increase in entropy is given by

- (A) $C_w \log (273)$
- (B) $C_w \log (T)$
- (C) $C_w \log_e \left(\frac{T}{273} \right)$
- (D) $C_w \log_e \left(\frac{273}{T} \right)$

where $C_w \rightarrow$ Specific heat of water

$T \rightarrow$ Boiling temperature in K

44. What is the primary alloying element in stainless steel that provides corrosion resistance?

- (A) Nickel
- (B) Chromium
- (C) Manganese
- (D) Carbon

45. In an overhanging beam, the point of contraflexure lies

- (A) between supports and overhang
- (B) at the centre
- (C) at the fixed end
- (D) nowhere

46. Polar moment of inertia is used in

- (A) bending
- (B) shear force
- (C) deflection
- (D) torsion

47. Which of the following is a water-tube boiler?

- (A) Locomotive boiler
- (B) Lancashire boiler
- (C) Babcock and Wilcox boiler
- (D) Cochran boiler

48. In a battery ignition system, the purpose of the condenser is to

- (A) start the engine
- (B) prevent arcing across contact points
- (C) generate high voltage
- (D) boost the spark

49. The toe-in and toe-out are crucial in

- (A) clutch engagement
- (B) wheel alignment and stability
- (C) fuel injection
- (D) emission control

50. Which of the following conditions will produce maximum force when a jet strikes a flat plate?

- (A) Jet strikes a stationary plate (flat) normally
- (B) Jet strikes a moving plate
- (C) Jet strikes the plate at an inclined angle
- (D) Jet strikes a curved vane tangentially

51. If a unit cell has atoms at all eight corners and one atom at centre, the structure is

- (A) face-centred cubic
- (B) simple cubic
- (C) body-centred cubic
- (D) hexagonal close packed

52. What is the main purpose of a thermostat in water-cooled engine?

- (A) Improve mileage
- (B) Improve viscosity
- (C) Maintain optimum operating temperature
- (D) Regulate engine RPM

53. The unit of capacitance is farad. Which of the following correctly defines 1 farad?

- (A) 1 volt per coulomb
- (B) 1 coulomb per volt
- (C) 1 coulomb per second
- (D) 1 volt per ampere

54. The velocity of flue gas (V) through the chimney under static draught of (H') metres is given by

- (A) $4.43 H'^2$
- (B) $(4.43 H')^2$
- (C) $4.43 \sqrt{H'}$
- (D) $4.43 H'$

55. Tyre tread pattern is essential for

- (A) heat dissipation
- (B) weight distribution
- (C) increasing tyre pressure
- (D) traction and water dispersion

56. Which of the following **does not** affect frictional force?
- (A) Surface roughness
 - (B) Area of contact
 - (C) Reaction of surface
 - (D) Force tending cause motion
57. A body subjected to thermal expansion but rigidly fixed at both ends develops
- (A) shear stress
 - (B) compressive stress
 - (C) tensile stress
 - (D) no stress
58. A condenser where circulating water flows through tubes which are surrounded by steam is known as
- (A) surface condenser
 - (B) barometric condenser
 - (C) evaporative condenser
 - (D) jet condenser
59. Which of the following is **not** a part of air intake system?
- (A) Silencer
 - (B) Air cleaner
 - (C) Intake manifold
 - (D) Throttle valve
60. The strength of a beam mainly depends on
- (A) bending moment
 - (B) centre of gravity of the section
 - (C) section modulus
 - (D) its weight
61. The difference between the upper limit and lower limit of a dimension is called
- (A) nominal size
 - (B) basic size
 - (C) actual size
 - (D) tolerance
62. A hacksaw blade cuts on
- (A) forward stroke
 - (B) return stroke
 - (C) both forward and return stroke
 - (D) cutting depends upon the direction of force
63. The point of contraflexure in a loaded beam refers to the section where
- (A) the bending moment is maximum
 - (B) the shear force is maximum
 - (C) the shear force is zero
 - (D) the bending moment changes sign
64. The viscosity of liquid _____ with increase in temperature.
- (A) decreases
 - (B) increases
 - (C) Both (A) and (B)
 - (D) None of the above

65. Newton's law of viscosity depends upon the

- (A) stress and strain in a fluid
- (B) shear stress, pressure and velocity
- (C) shear stress and rate of strain
- (D) viscosity and shear stress

66. The velocity distribution at any section of a pipe for steady laminar flow is

- (A) linear
- (B) exponential
- (C) parabolic
- (D) hyperbolic

67. Enthalpy is calculated as the

- (A) difference between the internal energy and product of pressure and density of the system
- (B) sum of internal energy and product of pressure and density of the system
- (C) sum of internal energy and product of pressure and volume of the system
- (D) difference between internal energy and product of pressure and volume of the system

68. The absorption-type dynamometer is a/an

- (A) torsion dynamometer
- (B) rope brake dynamometer
- (C) epicyclic-train dynamometer
- (D) None of the above

69. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have

- (A) free vibration
- (B) damped vibration
- (C) forced vibration
- (D) underdamped vibration

70. The relation between modulus of elasticity (E), modulus of rigidity (G) and bulk modulus (K) is given by

(A) $E = \frac{6KG}{G + 9K}$

(B) $E = \frac{9KG}{G + 3K}$

(C) $E = \frac{G + 9K}{3KG}$

(D) $E = \frac{G + 3K}{9KG}$

71. In order to avoid tearing off the plate at an edge, the distance from the centre of the rivet hole to the nearest edge of the plate (i.e., margin) should be

- (A) d (diameter of rivet)
- (B) $1.5d$
- (C) $2d$
- (D) $2.5d$

72. Most of the domestic refrigerators work on which of the following refrigeration systems?
- (A) Vapour absorption
 - (B) Vapour compression
 - (C) Carnot cycle
 - (D) Electrolux refrigerator
73. The firing order of a 6-cylinder in-line engine is usually
- (A) 1-5-3-6-2-4
 - (B) 1-6-3-5-2-4
 - (C) 1-4-3-2-6-5
 - (D) 1-3-6-2-4-5
74. The function of steering system is to convert
- (A) the rotary movement of the steering wheel into angular turn of the front wheel
 - (B) the angular turn of the front wheel into rotary movement of the steering wheel
 - (C) the linear motion of the wheel into vehicle acceleration
 - (D) the driver hand motion into brake application
75. When a shaft is subjected to a twisting moment, every cross-section of the shaft will be under
- (A) tensile stress
 - (B) compressive stress
 - (C) shear stress
 - (D) bending stress
76. Thermal conductivity of cutting tool must be
- (A) high
 - (B) low
 - (C) very low
 - (D) None of the above
77. Corrosion involves _____ reactions.
- (A) oxidation
 - (B) reduction
 - (C) displacement
 - (D) both oxidation and reduction
78. The spark ignition engines are governed by
- (A) hit and miss governing
 - (B) qualitative governing
 - (C) quantitative governing
 - (D) combination of (B) and (C)
79. The purpose of testing an Internal Combustion (IC) engine is
- (A) to determine the information, which cannot be obtained by calculations
 - (B) to conform the data used in design, the validity which may be doubtful
 - (C) to satisfy customer regarding the performance
 - (D) All of the above

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

- (A) work
- (B) power
- (C) inertia
- (D) energy

81. If the resultant of two forces P and Q acting at an angle θ makes an angle α with P , then

(A) $\tan \alpha = \frac{P \sin \theta}{Q - P \cos \theta}$

(B) $\tan \alpha = \frac{Q \sin \theta}{P + Q \cos \theta}$

(C) $\tan \alpha = \frac{Q \sin \theta}{P - Q \sin \theta}$

(D) $\tan \alpha = \frac{P \sin \theta}{P + Q \sin \theta}$

82. In a simple screw jack, with l as the length of the effort wheel and p as pitch of the screw, the velocity ratio is

(A) $\frac{\pi p}{2l}$

(B) $\frac{2\pi p}{l}$

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

(D) $\frac{2\pi l}{p}$

83. Which of the following statements is correct regarding the centre of gravity of a body?

- (A) It is the point where the entire weight of the body can be assumed to be concentrated.
- (B) It is always located within the material of the body.
- (C) It is dependent on the body's mass distribution.
- (D) It is the point where body is perfectly balanced.

84. A body floats in stable equilibrium

- (A) when its metacentric height is zero
- (B) when its metacentric height is above the centre of gravity
- (C) when CG is below the centre of buoyancy
- (D) Metacentre has nothing to do with the position of CG for determining stability

85. According to Bernoulli's equation

(A) $z + \frac{p}{w} + \frac{v^2}{2g} = \text{constant}$

(B) $z + \frac{p}{w} - \frac{v^2}{2g} = \text{constant}$

(C) $z - \frac{p}{w} + \frac{v^2}{2g} = \text{constant}$

(D) $z - \frac{p}{w} - \frac{v^2}{2g} = \text{constant}$

86. Steam turbine works on

- (A) Rankine cycle
- (B) Dual cycle
- (C) Otto cycle
- (D) None of the above

87. According to Kirchhoff's voltage law, the algebraic sum of all IR drops and emfs in any closed loop of a network

- (A) is always negative
- (B) remains same
- (C) is always zero
- (D) is always determined by emfs of the batteries

88. A transformer transforms

- (A) frequency
- (B) voltage
- (C) current
- (D) both voltage and current

89. Which of the following gases are used in Tungsten Inert Gas (TIG) welding?

- (A) Hydrogen and oxygen
- (B) Argon and neon
- (C) Argon and helium
- (D) Helium and neon

90. In a shaper, the length of stroke is increased by

- (A) increasing the length of arm
- (B) decreasing the centre distance of bull gear and crank pin
- (C) increasing the centre distance of bull gear and crank pin
- (D) decreasing the length of the slot in the slotted lever

91. Jigs are used

- (A) for holding and guiding the tool in drilling, reaming or tapping operation
- (B) for holding the work in milling, grinding, planing or turning operation
- (C) to check accuracy of the workpiece
- (D) None of the above

92. In case of refrigeration machine, COP will be

- (A) $\frac{Q_1}{Q_1 - Q_2}$
- (B) $\frac{Q_2}{Q_1 - Q_2}$
- (C) $\frac{Q_1}{Q_2 - Q_1}$
- (D) $\frac{Q_2}{Q_2 - Q_1}$

where

$Q_2 \rightarrow$ Heat extracted from the cold body

$Q_1 \rightarrow$ Heat rejected to the surrounding

93. The efficiency of Carnot cycle is

(A) $\frac{T_1}{T_2} - 1$

(B) $1 - \frac{T_1}{T_2}$

(C) $1 - \frac{T_2}{T_1}$

(D) $1 + \frac{T_1}{T_2}$

where T_1 and T_2 = Highest and lowest temperature during the cycle.

94. The stiffness is the ability of a material to resist

(A) deformation under stress

(B) fracture due to high impact load

(C) externally applied forces with breakdown or yielding

(D) None of the above

95. The process of increasing the hardness of steel by rapid cooling is called

(A) annealing

(B) normalizing

(C) quenching

(D) tempering

96. Stainless steel contains

(A) chromium, iron and nickel

(B) chromium and nickel

(C) tungsten, vanadium and chromium

(D) chromium, nickel, iron and carbon

97. The process of providing a thin layer of zinc coating on iron and steel is called

(A) electroplating

(B) galvanizing

(C) cementation

(D) None of the above

98. When sleeve of a Porter governor moves upwards, the governor speed

(A) first increases and then decreases

(B) decreases

(C) remains unaffected

(D) increases

99. In order to determine whether a column is long or short, one should know is

(A) length

(B) cross-section

(C) MI (moment of inertia)

(D) slenderness ratio

100. When the circulation of water in a boiler is by convection current which are set up during the heating of water, then the boiler is known as

(A) naturally circulation boiler

(B) externally fired boiler

(C) internally fired boiler

(D) forced circulation boiler

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SEAL

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MEJ/DRW/1/25/9/28-D

16

26T—430×4