

DO NOT OPEN THIS TEST BOOKLET TILL YOU ARE ASKED TO DO SO.

TR/TES/M-I/DIP/16

Test Booklet Series

TEST BOOKLET
MECHANICAL ENGINEERING PAPER – I
(DIPLOMA)

C

(Signature of the Candidate)

(Invigilator's Signature)

Time Allowed–3 hours (Three hours)

Maximum Marks–200

I N S T R U C T I O N S

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS ETC. IF SO, GET IT REPLACED BY A TEST BOOKLET OF SAME SERIES.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES IN THE APPROPRIATE PLACE IN THE ANSWER SHEET BY BLACK BALL POINT PEN ONLY.
3. This Test Booklet is divided into three sections, i.e Section - A, Section - B & Section - C.
(A) Section -A (MCQ pattern) contains 40 items (questions). Each question, carrying 2 (two) marks only, has four responses (answers). You will select the response which you want to mark on the OMR Sheet. In case you feel that there is more than one correct response, mark the response which you consider the most appropriate. In any case, choose ONLY ONE response for each item. There shall be no negative marking for wrong / multiple answer.
(B) Questions under Section -B (Conventional Method) & Section -C (Conventional Method) are to be answered in separate answer book.
4. You have to mark all your responses of Section - A by Black Ball Point Pen only on the separate OMR Answer Sheet provided. See directions in the Answer Sheet.
5. Before you proceed to answer the responses to various items in the Test Booklet, you have fill in some particulars both in the Answer Sheet for Section-A and in the Answer Book for Section – B and Section – C.
6. On completion of the Examination, you should hand over the OMR Answer Sheet for Section – A & Answer Book for Section – B & C to the Invigilator only. You are permitted to take the Test Booklet with you.
7. Sheets for rough work are appended on the Test Booklet at the end.

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All symbols have their usual meaning

The figures in the margin indicate full marks for the questions.

SECTION - A

Answer *all* questions. Each question carries 2 marks.

40×2=80

Choose the correct answer from the four alternatives provided with each question and mark on the OMR Sheet.

Example : Poise is the unit of

(A) Surface tension

● Coefficient of viscosity

(B) Buoyant force

(D) Gravitational force

1. A cylindrical elastic body subjected to pure tension about its axis develops
 - (A) Tensile stress in a direction 45° to the axis
 - (B) No tensile or compressive stress
 - (C) Maximum shear stress along the axis of shaft
 - (D) Maximum shear stress at 45° to the axis
2. A rod of length L and diameter D is subjected to a tensile load P . Which of the following is sufficient to calculate the resulting change in diameter ?
 - (A) Young's modulus
 - (B) Shear modulus
 - (C) Poisson's ratio
 - (D) Both Young's modulus and Shear modulus
3. A static fluid can have
 - (A) non zero normal and shear stress
 - (B) negative normal stress and zero shear stress
 - (C) positive normal stress and zero shear stress
 - (D) zero normal stress and non-zero shear stress
4. For a completely submerged body with centre of gravity 'G' and centre of buoyancy 'B', the condition of stability will be
 - (A) G is located below 'B'
 - (B) G is located above 'B'
 - (C) 'G' and 'B' are coincident
 - (D) independent of the location of 'G' and 'B'
5. Increase in carbon content in plain carbon steel raise its
 - (A) ductility and UTS
 - (B) tensile strength and malleability
 - (C) tensile strength and hardness
 - (D) ductility and melting temperature
6. The size of BUE in metal cutting increases with
 - (A) very high speed
 - (B) large uncut chip thickness
 - (C) use of cutting fluid
 - (D) increase in positive rake angle

7. In turning operation the surface finish can be improved by decreasing

- (A) cutting speed
- (B) feed per revolution
- (C) rake angle
- (D) nose radius

8. A thin cylinder of inner radius 500mm and thickness 10mm is subjected to an internal pressure of 5 Mpa. The average circumferential (hoop) stress in Mpa is

- (A) 100
- (B) 250
- (C) 500
- (D) 1000

9. A fluid is said to be Newtonian fluid when the shear stress is

- (A) directly proportional to the velocity gradient
- (B) inversely proportional to the velocity gradient
- (C) independent of the velocity gradient
- (D) none of these

10. A long thin walled cylindrical shell closed at both the ends, is subjected to an internal pressure. The ratio of the hoop stress (circumferential stress) to longitudinal stress developed in the shell is

- (A) 0.5
- (B) 1.0
- (C) 2.0
- (D) 4.0

11. The dimension of surface tension is

- (A) ML^{-1}
- (B) $L^2 T^{-1}$
- (C) $ML^{-1} T^{-1}$
- (D) MT^{-2}

12. A grinding wheel is said to be glazed if

- (A) grains have become blunt but do not fall out
- (B) gap between the grains is filled by swarf
- (C) it becomes black due to burning
- (D) part of the wheel is chipped off.

13. The heat generated in metal cutting is dissipated in different proportions into environment, tool, chip and work piece. The correct order of this proportion in decreasing magnitude is (no cutting fluid used)
- tool, work, chip, environment
 - work, tool, chip, environment
 - tool, chip, environment, work
 - chip, tool, work, environment
14. A weighing machine consists of a 2 kg pan is resting on a spring. In this condition, with the pan resting on the spring, the length of the spring is 200 mm. When a mass of 20 kg is placed on the pan, the length of the spring becomes 100 mm. For the spring, the undeformed length L and the spring constant K (stiffness) are
- $L = 220$ mm, $K = 1862$ N/m
 - $L = 210$ mm, $K = 1960$ N/m
 - $L = 200$ mm, $K = 1960$ N/m
 - $L = 200$ mm, $K = 2156$ N/m
15. For a simply supported beam on two end supports the bending moment is maximum
- usually on the supports
 - always at mid span
 - where there is no shear force
 - where the deflection is maximum
16. Streamlines, path lines and streak lines are virtually identical for
- Uniform flow
 - Flow of ideal fluids
 - Steady flow
 - Non uniform flow
17. A circular plate 1 m in diameter is submerged vertically in water such that its upper edge is 8 m below the free surface of water. The total hydrostatic pressure force on one side of plate is
- 6.7 KN
 - 65.4 KN
 - 45.0 KN
 - 77.0 KN
18. In a shaper, the mechanism for tool feed is
- Geneva mechanism
 - Whitworth mechanism
 - Ratchet and pawl mechanism
 - Ward- Leonard system
19. Only negative rake angles are used with the following tool material
- HSS
 - Carbon tool steels
 - Carbides
 - Diamonds

20. A lead screw with half nuts in a lathe, free to rotate in both directions has
- V- threads
 - With worth threads
 - Buttress threads
 - Acme threads
21. A concentrated load P acts on a simply supported beam of span L at a distance $L/3$ from the left support. The bending moment at the point of application of the load is given by
- $PL / 3$
 - $2PL / 3$
 - $PL / 9$
 - $2PL / 9$
22. In terms of Poisson's ratio (μ) the ratio of Young's modulus (E) to shear modulus (G) of elastic material is
- $2(1+\mu)$
 - $2(1-\mu)$
 - $1/2(1+\mu)$
 - $1/2(1-\mu)$
23. As a ship enters into a river from sea, one can expect that
- it rises a little
 - it sinks a little
 - it remains at the same level
 - its level depends on the material used for construction
24. The measurement of flow rate in a pipe is done by a combination of venturimeter and
- V-notch
 - pitot tube
 - orifice meter
 - manometer
25. In a reaction turbine
- it is possible to regulate the flow without loss
 - it must be placed at the foot of the fall and above the tail race
 - workdone is purely by the change in the kinetic energy of the jet
 - only part of head is converted into velocity before the water enters the wheel.
26. If the longitudinal feed in centre less grinding is expressed by $V = \pi DN \sin \alpha$, D stands for
- diameter of blank
 - diameter of finished workpiece
 - diameter of control wheel
 - diameter of grinding wheel
27. In a typical metal cutting operation, using a cutting tool a positive rake, $\alpha = 10^\circ$, it is as observed that the shear angle was 20° . The friction angle is
- 45°
 - 30°
 - 60°
 - 40°

28. Hardness of steel greatly improves with
- Annealing
 - Cyaniding
 - Normalising
 - Tempering
29. A bucket of water is hanging from a spring balance. An iron piece is suspended into water without touching any of the side of bucket from another support. The spring balance reading will
- Increase
 - Decrease
 - Remain same
 - Depend on the depth of immersion
30. A shaft subjected to torsion experiences a pure shear stress ' τ ' on the surface. The maximum principal stress on the surface which is at 45° to the axis will have a value
- $\tau \cos 45^\circ$
 - $2\tau \cos 45^\circ$
 - $\tau \cos^2 45^\circ$
 - $2\tau \sin 45^\circ \cos 45^\circ$
31. A milling cutter having 10 teeth is rotating at 100 rpm. The feed is set at 50 mm per minute. The feed per tooth in mm is
- 5
 - 0.5
 - 0.2
 - 0.05
32. In orthogonal machining operation, the chip thickness and the uncut chip thickness are equal to 0.45 mm. If the tool rake is 0° , the shear plane angle is
- 45°
 - 30°
 - 18°
 - 60°
33. What are the forces that influence the problem of fluid statics ?
- Gravity and viscous forces
 - Gravity and pressure forces
 - Viscous and surface tension forces
 - Gravity and surface tension forces
34. Consider the energies associated with pelton turbine :
- Mechanical energy
 - Kinetic energy
 - Potential energy
- The correct sequence of energy conservation starting from entry of fluid is
- 1, 2 and 3
 - 2, 3 and 1
 - 3, 2, and 1
 - 1, 3, and 2
35. The decibel is unit of measuring
- relative loudness of sound
 - frequency of sound wave
 - amplitude of sound wave
 - wavelength of sound wave

36. The percentage of Nitrogen in the air is
 (A) 70%
 (B) 60%
 (C) 78%
 (D) 90%
37. According to WHO, the maximum permissible limit of Arsenic in the drinking water is
 (A) 0.08 mg / litre
 (B) 0.02 mg / litre
 (C) 0.10 mg / litre
 (D) 0.05 mg / litre
38. The World Environment day is celebrated on
 (A) 5th June
 (B) 15th June
 (C) 7th July
 (D) 1st June
39. The air pressure is measured by
 (A) Lactometer
 (B) Audiometer
 (C) Barometer
 (D) None of these
40. Names of some water turbines are given below :
 1. Francis turbine
 2. Kaplan turbine
 3. Pelton turbine
 4. Propeller turbine
- Which of the above turbines maintain a high efficiency over a long range of the part load ?
- Select the correct answer using codes given below :
- (A) 1 and 4 only
 (B) 2 and 3 only
 (C) 1, 2 and 3
 (D) 2, 3 and 4

SECTION – B

Each question carries 6 marks.

Answer *all* questions.

15×6=90

1. (a) Write the difference between shaper and planner.

(b) What is shrinkage allowance ?

4+2=6

2. (a) How is the cutting speed calculated in turning operation ?

(b) Write three specifications of a lathe.

3+3=6

3. (a) What is up and down milling ?
(b) Write name of materials by which abrasive wheel is produced. 4+2=6
4. (a) How is the drilling operation performed ?
(b) What is the composition of high speed steel used as a cutting tool ? 4+2=6
5. (a) Draw the stress and strain curve and mention all the points.
(b) What is hardness ? 4+2=6
6. (a) There are two springs having stiffness K_1 and K_2 respectively arranged in a series. Calculate the stiffness of arranged spring.
(b) Define torsion of a shaft with schematic diagram. 3+3=6
7. (a) When the rivet joint is required ? Explain with your own words.
(b) What is toughness of a material ? 4+2=6
8. (a) What is viscosity and capillarity ?
(b) Distinguish between non-Newtonian fluid and ideal fluid. 3+3=6
9. (a) What is buoyant force ?
(b) Distinguish between compressible, steady, and unsteady flow. 2+4=6
10. (a) How is a mercury manometer used to measure the static pressure at a point in a water pipe ?
(b) What is orifice-meter ? 4+2=6
11. (a) How is the centrifugal pump lifting the water ?
(b) What is cavitation ? 4+2=6

12. (a) Distinguish between open impeller and closed impeller.

4+2=6

(b) What is net positive suction head (NPSH) ?

13. (a) What is acid rain ?

3+3=6

(b) What is greenhouse effect ?

14. (a) Describe the effect of noise pollution.

4+2=6

(b) How is the human being protected by ozone (O_3) ?

15. (a) How is the water polluted by human being ?

4+2=6

(b) What kind of minerals are present in the drinking water ?

SECTION – C

Answer *all* the questions.

Each question carries 6(six) marks.

5×6=30

1. A 200 mm long, stress free rod at room temperature is held between two immovable rigid walls. The temperature of the rod is uniformly raised by 250°C , the Young's modulus and coefficient of thermal expansion are 200 GPa and $1 \times 10^{-5}/^{\circ}\text{C}$ respectively. Calculate the magnitude of the longitudinal stress (in MPa) developed in the rod.
2. Maximum shear stress developed on the surface of a solid circular shaft under pure torque is 240 MPa. If the shaft diameter is doubled then calculate the maximum shear stress developed under same torque.
3. An open rectangular box of base $2\text{m} \times 2\text{m}$ contains a liquid of specific gravity 0.80 up to a height of 2.5 m. If the box imparted vertically upward acceleration of 4.9 m/s^2 , what will be the pressure on the base of the tank ?
4. A 0.20m diameter pipe 20 Km long transports oil at a flow rate of $0.01\text{m}^3/\text{s}$. Calculate power required to maintain flow if dynamic viscosity and density of oil is 0.08 Pa.s and 900 Kg/m^3 respectively.
5. For turning Ni-Cr alloy steel at cutting speeds of 64 m/min and 100 m/min, the respective tool lives are 15 mins and 12 mins. Calculate the tool life for a cutting speed of 144 m/min.