Booklet Series

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10/CME/M–2025-08

Question Booklet

MECHANICAL ENGINEERING

Paper – VI

Booklet Serial No.

2560607

Candidate's Roll Number

Time Allowed : 01 Hour

Maximum Marks : 100

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

IMPORTANT INSTRUCTIONS

1. This Question Booklet contains **50** questions in all.
2. **All** questions carry equal marks.
3. Attempt **all** questions.
4. An Answer Sheet has been supplied inside the question booklet to mark the answers. **You must write your Roll Number and encode it and write other particulars in the space provided in the Answer Sheet, failing which your Answer Sheet will not be evaluated.**
5. **Immediately after commencement of the examination, you should check up your Question Booklet and attached answer sheet and ensure that the Question Booklet Series is printed on the top left-hand corner of the Booklet and the series encoded in answer sheet are same. Also please check that the Booklet contains 12 printed pages including two pages (Page Nos. 11 and 12) for Rough Work and no page or question is missing or unprinted or torn or repeated or question booklet and answer sheet have different series. If you find any defect in this Booklet and attached answer sheet, get it replaced immediately by a complete Booklet with OMR sheet of the same series.**
6. You must write your Roll Number in the space provided on the top of this page. Do not write anything else on the Question Booklet.
7. Questions and their responses are printed in English version in this Booklet. Each question comprises of **four** responses — (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark it in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
8. In the Answer Sheet, there are **four** circles — Ⓐ, Ⓑ, Ⓒ and Ⓓ against each question. To answer the questions, you are to mark with **Black/Blue ink ballpoint pen ONLY ONE circle** of your choice for each question. Select only one response for each question and mark it in your Answer Sheet. If you mark more than one circle for one question, the answer will be treated as wrong. **Use Black/Blue ink ballpoint pen only to mark the answer in the Answer Sheet. Any erasure or change is not allowed.**
9. You should not remove or tear off any sheet from the Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. **After the examination has concluded, you must hand over your Answer Sheet to the Invigilator**. Thereafter, you are permitted to take away the Question Booklet with you.
10. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
11. Candidates must assure before leaving the Examination Hall that their Answer Sheets will be kept in Self Adhesive LDPE Bag and completely packed/sealed in their presence.

1. Consider a horizontal beam of length L supported at two locations l m apart with equal overhangs. If the beam carries a point load W at midspan and the downward deflection at the centre is equal to the upward deflection at either end, then the ratio of L/l will be

(A) 3/5

(B) 16/5

(C) 5/3

(D) 15/16

2. When bevel gears with equal teeth and equal pitch angles connect two shafts intersecting at a right angle, then the gear ratio will be approximately

(A) 1 : 1

(B) 1 : 5

(C) 1 : 1.5

(D) 10 : 1

3. A buckyball is

(A) A carbon molecule (C60)

(B) Concrete nanoparticle with a compressive strength of 20 nanonewtons (C20)

(C) Nickname for Mercedes-Benz's futuristic concept car (C111)

(D) Plastic explosives nanoparticle (C4)

4. The work holding device which holds and positions the work, as well as locate or position the cutting tool and guide it relative to work piece is

(A) Jig

(B) Fixture

(C) Universal 3-Jaw chuck

(D) Indexing

5. If a solid steel rod of diameter 200 mm, length 10 m, specific weight 9×10^{-5} N/mm^3, modulus of rigidity 1×10^5 N/mm^2 and Poisson's ratio 0.25 is hanged vertically from top end, then the total elongation due to its own weight would be approximately

(A) 0.018 mm

(B) 0.0036 mm

(C) 0.36 mm

(D) 0.036 mm

6. During iterations, while moving from one solution to the next, degeneracy may occur when

(A) two or more occupied cells are on the closed path but neither of them represents a corner of the path

(B) two or more occupied cells on the closed path with minus sign are tied for lowest circled value

(C) the closed path indicates a diagonal move

(D) the closed path indicates a rectangle move

7. As temperature of a polymer increases, its glass transition temperature (Tg)

(A) has no significant effect

(B) decreases

(C) increases

(D) none of these

8. What will be the acceleration of the bob of a simple pendulum at the mid-point of its swing when it is executing small oscillations and air resistance is neglected ?

(A) Will vary and depends on the length of the pendulum and the mass of the bob

(B) Zero

(C) Maximum

(D) Minimum but not zero

9. The low permeability in sand can cause which of the following defects in casting ?

(A) blow holes

(B) drop

(C) hot tears

(D) rough surface

10. The axial thrust on worm gear is the

(A) product of tangential force acting on the worm to tangent of lead angle

(B) ratio of tangential force acting on the worm to tangent of lead angle

(C) ratio of tangential force acting on the worm to tangent of pressure angle

(D) product of tangential force acting on the worm to tangent of pressure angle

11. The following type of jig is used for machining in more than one plane

(A) Open type jig

(B) Plate type jig

(C) Template jig

(D) Box type jig

12. Which of the following uses probabilistic time estimates ?

(A) Control chart

(B) Gantt chart

(C) PERT

(D) CPM

13. If the Poisson's ratio of a particular steel material is 0.25, then the elastic modulus for the same steel material is

(A) 2.5 times its shear modulus

(B) 1.25 times its shear modulus

(C) 0.25 times its shear modulus

(D) 0.5 times its shear modulus

14. Which of the following statement is correct about nose radius of a single point cutting tool ?

(A) It improves tool life but reduces the surface finish

(B) It improves the surface finish and tool life

(C) It improves tool life

(D) It improves the surface finish

15. If the tearing efficiency of a riveted joint is 65%, then the ratio of diameter of rivet hole to the pitch of rivets is

(A) 1.65

(B) 0.55

(C) 0.65

(D) 0.35

16. In the iron-carbon phase diagram

(A) adding nickel (Ni) to the iron-carbon alloy (steel) will generally lower the A3 boundary while adding chromium (Cr) will raise it

(B) adding nickel (Ni) and chromium (Cr) to the iron-carbon alloy (steel) will generally raise the A3 boundary

(C) adding chromium (Cr) to the iron-carbon alloy (steel) will generally lower the A3 boundary while adding nickel (Ni) will raise it

(D) adding nickel (Ni) and chromium (Cr) to the iron-carbon alloy (steel) will generally lower the A3 boundary

17. Primary unbalance force due to inertia of reciprocating parts of mass m at a radius r moving with an angular velocity ω is

(A) $mr\omega^2 \sin\left(\frac{2\theta}{n}\right)$

(B) $mr\omega^2 \cos\left(\frac{2\theta}{n}\right)$

(C) $mr\omega^2\cos\theta$

(D) $mr\omega^2\sin\theta$

18. Which of the following is referred to as MRP II ?

(A) Manufacturing Requirement Planning

(B) Materials Resources Planning

(C) Manufacturing Resources Planning

(D) Materials Requirement Planning

19. The thickness for a steel cylindrical shell of internal diameter 100 mm to withstand an internal pressure of 50 N/mm^2 and hoop stress of 150 N/mm^2 would be approximately

(A) 15 mm

(B) 30 mm

(C) 20 mm

(D) 25 mm

20. For a stable governor, if the equilibrium speed increases

(A) the radius of governor balls changes continuously on both sides

(B) the radius of governor balls remains constant

(C) the radius of governor balls decreases

(D) the radius of governor balls also increases

21. The dissipation of energy in a polymer material under cyclic loading is

(A) damping

(B) storage modulus

(C) loss modulus

(D) none of these

22. In a power transmission of the shaft, key and pulley, the driven pulley is overhung to an extent of 300 mm from the nearest bearing and is mounted on a shaft having a permissible shear stress of 400 N/mm^2 with the help of key. If the equivalent twisting moment acting on the shaft is 1256×10^6 N-mm, then the designed diameter of the shaft will be approximately

(A) 60 mm

(B) 40 mm

(C) 52 mm

(D) 48 mm

23. What will be the average waiting time for a customer for service if the average arrival rate in a single server queuing system is 20 customers per hour and average service rate is 30 customers per hour ?

(A) 3 minutes

(B) 1/15 minutes

(C) 1.5 minutes

(D) 4 minutes

24. If the ratio of circular frequency of the system to natural circular frequency of the system in a vibration isolation system is less than $\sqrt{2}$, then for all values of the damping factor, the transmissibility will be

(A) equal to unity

(B) less than unity

(C) zero

(D) greater than unity

25. It is required to cut screw threads of 1.8 mm pitch on a lathe. The lead screw has a pitch of 5 mm. If the spindle speed is 90 r.p.m., then the speed of lead screw will be

(A) 64.8 r.p.m.

(B) 32.4 r.p.m.

(C) 18 r.p.m.

(D) 20 r.p.m.

26. Incentives schemes where earnings differ at different levels of output are

(A) Gantt task system and Emersons's efficiency plan

(B) Emersons's efficiency plan, Gantt task system and Rowman plan

(C) Bedaux plan, Gantt task system and Rowman plan

(D) Halsey plan and Bedaux plan

27. A 100 mm diameter solid shaft is welded to a flat plate by 10 mm fillet weld. If the maximum shear stress in the weld material is not to exceed 100 N/mm^2, then the maximum torque that the welded joint can sustain is

(A) 785 N-m

(B) 1570 N-m

(C) 6280 N-m

(D) 3140 N-m

28. Which of the following theorists suggests that a reduction in variation of a product or process represents a "lower loss" to society ?

(A) Ishikawa

(B) Deming

(C) Juran

(D) Taguchi

29. A steel hub of 80 mm internal diameter and uniform thickness of 8 mm was heated to 320°C to shrink-fit it on a shaft, then

(A) the hub is subjected to tensile hoop stress and shaft is subjected to compressive stress

(B) the hub is subjected to compressive stress and shaft is subjected to tensile hoop stress

(C) the hub and shaft are subjected to tensile hoop stress

(D) the hub and shaft are subjected to compressive stress

30. In case of escalators, the material handling device, the most common angles of incline from horizontal is

(A) 42° to 46°

(B) 30° to 35°

(C) 8° to 10°

(D) 12° to 15°

31. A steel plate 100 mm wide and 20 mm thick is bent into a circular arc of radius 12 m. If the modulus of elasticity of the steel plate is 2×10^5 N/mm^2, then the maximum stress induced would be approximately

(A) 200 N/mm^2

(B) 167 N/mm^2

(C) 120 N/mm^2

(D) 150 N/mm^2

32. In drawing operation, increase of punch radius

(A) Punch load depends on other factors

(B) Does not influence the punch load much

(C) Has much influence on punch load and it decreases

(D) Punch load increases

33. If the helix angle of a helical gear pair is decreased from 45 to 40 degrees, the maximum or limiting load capacity of the pair will

(A) remains unchanged

(B) slightly increase

(C) decrease

(D) largely increase

34. The method to find an initial solution based on opportunity costs is

(A) Flood's technique

(B) Hungarian method

(C) Johanson's theorem

(D) Vogel's approximation method

35. What is the colour of nanogold ?

(A) varying colour, depending on the size and shape

(B) white and yellow

(C) yellow

(D) white

36. Stellite 6 is an alloy composed of

(A) 27%-32% chromium, 3%-6% tungsten, 0.9%-2% carbon, 3%-4% nickel, 1%-2% silicon, 3%-4% iron and balance cobalt

(B) 27%-32% chromium, 3%-6% tungsten, 0.9%-2% carbon, 3%-4% nickel, 1%-2% silicon, 3%-4% cobalt and balance iron

(C) 27%-32% chromium, 3%-6% tungsten, 0.9%-2% carbon and balance cobalt

(D) 27%-32% chromium, 3%-6% tungsten, 0.9%-2% carbon, 3%-4% nickel, 1%-2% silicon and balance iron

37. Which of the following is the best explanation of the relevance of equivalent production units in process costing ?

(A) A means of equalizing production charges into stock each period

(B) A means by which the output achieved may be compared with the equivalent quantity budgeted for the period under review

(C) The conversion of partly completed units into an equivalent number of completed units in order that costs may be shared equitably

(D) The expression of losses in terms of an equivalent number of units of good production in order that their value may be calculated

38. When a lap joint is subjected to Tensile load, the stress induced in the rivets is

(A) Bending stress

(B) Tensile stress

(C) Shear stress

(D) Compressive stress

39. A group of high-performance alloys designed to meet high temperature strength, resistance to creep and surface degradation

(A) Superalloys

(B) Hybrid composites

(C) Cermets

(D) Boiler steels

40. Fatigue failure results due to fluctuating stresses when the stress magnitude is

(A) lower than yield strength

(B) more than ultimate tensile strength

(C) more than yield strength but lower than ultimate tensile strength

(D) none of the above

41. The number of allocations in a basic feasible solution in a transportation matrix of l sources and m destination will be

(A) $l + m + 1$

(B) $l + m - 1$

(C) $l - m$

(D) $l + m$

42. When a nut is tightened by placing a washer below it

(A) the bolt will be subjected to tensile stress and washer will be subjected to compressive stress

(B) both the bolt and washer will be subjected to combined tensile, compressive and shear stress

(C) the bolt and washer will be subjected to tensile stress

(D) the bolt and washer will be subjected to compressive stress

43. Which reaction contains a higher concentration of a specific element than the solid phase at that temperature ? In this case, the primary solid phase and the liquid phase react to form a secondary solid phase.

(A) hyper-eutectiod reaction

(B) hyper-eutectic reaction

(C) peritectiod reaction

(D) hyper-peritectic reaction

44. If a particle of a link has a velocity when changes both in magnitude and direction at any instant, then

(A) It must have four components of acceleration e.g. centripetal, centrifugal, gravitational and tangential

(B) It must have three components of acceleration e.g. centripetal, centrifugal and gravitational

(C) It must have two components of acceleration e.g. centripetal and tangential

(D) It must have three components of acceleration e.g. centripetal, centrifugal and tangential

45. Consider two circular columns - one hollow and the other solid, made of the same material and have the equal length, equal cross-sectional area and similar end conditions. If the internal diameter of the hollow column is half of its external diameter, then the ratio of the buckling strengths of two circular columns is nearly

(A) 1/2

(B) 15/16

(C) 4/3

(D) 5/3

46. Which of the following is a mechanism for mechanized movements of the carriage along longitudinal axis ?

(A) Apron

(B) Saddle

(C) Cross-slide

(D) Compound rest

47. A journal bearing of a centrifugal pump having a length of 200 mm and diameter 100 mm is rotating at 1000 rpm and the load acting on it is 30000 N. If the absolute viscosity of an SAE 10 lubricant is 8.14×10^{-2} N-s/m^2 at 20°C, then the bearing will operate under hydrodynamic conditions

(A) Dry conditions

(B) Semi- liquid conditions

(C) Hydrostatic conditions

(D) Hydrodynamic conditions

48. During blanking and punching, as the clearance between the punch and die increases, the punch force required

(A) First increases and then decreases

(B) Remains same

(C) Decreases

(D) Increases

49. The two links OL and OM are connected by a pin joint at O. If the link OL turns with angular velocity of 10 rad/s in the clockwise direction and the link OM turns with 5 rad/s in the anti-clockwise direction, then the rubbing velocity at the pin joint O is

(A) fifty times its shear modulus

(B) fifteen times radius of the pin at O

(C) five times radius of the pin at O

(D) ten times radius of the pin at O

50. The maximum shear stress for a crankshaft 200 mm diameter subjected to a bending moment of 20 kN-m and twisting moment of 35 kN-m is approximately

(A) 35 N/mm^2

(B) 30 N/mm^2

(C) 20 N/mm^2

(D) 25 N/mm^2

SPACE FOR ROUGH WORK

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