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T. B. C. : AEM – 1/2015

Test Booklet Series

Serial No. 21901

A

TEST BOOKLET

ASSISTANT EXECUTIVE ENGINEER

MECHANICAL ENGINEERING (PAPER – I)

Time Allowed : 3 Hours

Maximum Marks : 180

: INSTRUCTIONS TO CANDIDATES :

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 COMPLETE TEST BOOKLET OF THE SAME SERIES ISSUED TO YOU.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D**, AS THE CASE MAY BE, IN THE APPROPRIATE PLACE IN THE ANSWER SHEET USING BALL POINT PEN (BLUE OR BLACK).
3. You have to enter your **Roll No.** on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains **90** items (questions). Each item (question) comprises four responses (answers). You have to select the correct response (answer) which you want to mark (darken) on the Answer Sheet. In case, you feel that there is more than one correct response (answer), you should mark (darken) the response (answer) which you consider the best. In any case, choose **ONLY ONE** response (answer) for each item (question).
5. You have to mark (darken) all your responses (answers) **ONLY** on the **separate Answer Sheet** provided, by **using BALL POINT PEN (BLUE OR BLACK).** See instructions in the Answer Sheet.
6. All items (questions) carry equal marks. All items (questions) are compulsory. Your total marks will depend only on the number of correct responses (answers) marked by you in the Answer Sheet. **There will be no negative marking for wrong answer.**
7. Before you proceed to mark (darken) in the Answer Sheet the responses to various items (questions) in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per the instructions in your **Admission Certificate.**
8. After you have completed filling in all your responses (answers) on the Answer Sheet and after conclusion of the examination, you should hand over to the Invigilator the *Answer Sheet* issued to you. You are allowed to take with you the candidate's copy/second page of the Answer Sheet along with the *Test Booklet* after completion of the examination for your reference.

SEAL

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1. Locked chain satisfy Equation (i) $n = 2p - 4$, Equation (ii) $j = \frac{3}{2}n - 2$:
   (A) Only Equation (i)
   (B) Only Equation (ii)
   (C) Satisfy both the Equations
   (D) Doesn't satisfy both the Equations

2. Roller bearing is a :
   (A) Spherical pair
   (B) Higher pair
   (C) Lower pair
   (D) Cylindrical pair

3. One of the following mechanisms is not exact straight line mechanism :
   (A) Grasshopper Mechanism
   (B) Hart Mechanism
   (C) Scott Russel Mechanism
   (D) Peaucellier Mechanism

4. Which of the following is an inversion of single slider crank chain ?
   (A) Hand pump
   (B) Oldham's coupling
   (C) Scotch yoke
   (D) Elliptical trammel

5. The size of gears is usually specified by :
   (A) Circular pitch
   (B) Outside diameter
   (C) Pitch circle diameter
   (D) Inside diameter

6. One of the following is not pure rotation :
   (A) Windmill
   (B) The minutes hand of a clock
   (C) Bicycle wheel
   (D) Flywheel

7. Knee joint of a human being has _____ degree(s) of freedom.
   (A) One
   (B) Two
   (C) Three
   (D) Zero

8. The frictional torque transmitted by a plate clutch is same as that of :
   (A) Flat pivot bearing
   (B) Flat collar bearing
   (C) Conical pivot bearing
   (D) Trapezoidal pivot bearing

9. The tractive resistance during the propulsion of a wheeled vehicle depends on :
   (A) Road resistance
   (B) Aerodynamic resistance
   (C) Gradient resistance
   (D) All of these

10. The size of gears is usually specified by :
    (A) Circular pitch
    (B) Outside diameter
    (C) Pitch circle diameter
    (D) Inside diameter

11. In a reverted gear train, the axes of the first and the last gear are :

(A) Parallel

(B) Co-axial

(C) Neither parallel nor co-axial

(D) Perpendicular

12. The axis of spin, the axis of precession and the axis of gyroscopic torque are in :

(A) Two parallel planes

(B) Two perpendicular planes

(C) Three perpendicular planes

(D) Three parallel planes

13. The critical speed of a rotating shaft with a mass at the centre is _____ the natural frequency of transverse vibration of the system.

(A) Equal

(B) Less than

(C) More than

(D) Dependent upon

14. A torsional vibratory system having two rotors connected by a shaft has :

(A) One node

(B) Two nodes

(C) Three nodes

(D) No node

15. The gyroscopic acceleration depends upon :

(A) Instantaneous value of ω

(B) The rate at which the axis of spin changes its speed

(C) Both (A) and (B)

(D) None of these

16. The normal circular pitch in helical gears is given by :

(A) $p \sin \psi$

(B) $p / \sin \psi$

(C) $p \cos \psi$

(D) $p / \cos \psi$

17. A differential uses _____ gear train.

(A) Simple

(B) Epicyclic

(C) Reverted

(D) Compound

18. Wire ropes used in lifts and hoists are :

(A) Cross ply

(B) Regular lay

(C) Long lay

(D) Reverse laid ropes

19. Angle of twist allowed in case of camshaft is :

(A) Dependent on its length

(B) Restricted to $\frac{1}{2}^{o}$ irrespective of length of the shaft

(C) Depending on the torque acting on it

(D) Dependent on the nature of the engine (i.e. 4 stroke or 2 stroke)

20. Woodruff key is used for :

(A) Heavy torque at high speeds

(B) Low torque at high speeds

(C) Heavy torque at low speeds

(D) Low torque at low speeds

21. An open coiled helical spring is subjected to an axial force ; the wire of the spring is subjected to :

(A) Direct shear only

(B) Combined shear and bending only

(C) Combined shear, bending and twisting

(D) Combined shear and twisting only

22. Two shafts A and B are made of same material. The diameter of shaft B is twice that of shaft A. The ratio of power which can be transmitted by shaft A to that of shaft B is :

(A) 1/2

(B) 1/4

(C) 1/8

(D) 1/16

23. In a multiple V-belt drive, when a single belt is damaged, it is preferable to change the entire set to :

(A) Reduce vibration

(B) Reduce slip

(C) Ensure unifrom loading

(D) Ensure proper alignment

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

(A) Positive drive-belt drive

(B) High velocity ratio-worm gearing

(C) Nonparallel and non-intersecting-spiral gear

(D) Diminished noise and smooth operation-helical gear

25. In case of flywheel, the maximum fluctuation of energy is the :

(A) Sum of maximum and minimum energies

(B) Difference between the maximum and minimum energies

(C) Ratio of maximum and minimum energies

(D) Ratio of minimum and maximum energies

26. When a helical compression spring is cut into two equal halves, the stiffness of each of the resulting springs will be :

(A) Unaltered

(B) One half

(C) Doubled

(D) One fourth

27. _____ Thread has an inclined angle of 290.

(A) Acme

(B) Buttress

(C) British Association

(D) Square

28. In order to have smooth operation, the minimum number of teeth on the small sprocket for moderate speed should be :

(A) 15

(B) 17

(C) 21

(D) 25

29. To increase the capacity of ball bearing _____ is provided to increase the number of balls in the bearing.

(A) Grease

(B) Collar

(C) Filling notch

(D) Less gap

30. One of the following power screws transmit power in one direction only :

(A) Buttress thread

(B) Acme thread

(C) Square thread

(D) Trapezoidal thread

31. A solid shaft transmits a torque of T. The allowable shear stress is τ. What is the diameter of the shaft ?

(A) $\sqrt[3]{\frac{16T}{\pi r}}$

(B) $\sqrt[3]{\frac{32T}{\pi r}}$

(C) $\sqrt[3]{\frac{16T}{\tau}}$

(D) $\sqrt[3]{\frac{T}{\pi}}$

32. A thin cylinder with both ends closed is subjected to internal pressure p. The longitudinal stress at the surface has been calculated as σ_0. Maximum shear stress at the surface will be equal to :

(A) $2\sigma_0$

(B) $1.5\sigma_0$

(C) σ_0

(D) $0.5\sigma_0$

33. In a thick cylinder pressurized from inside, the hoop stress is maximum at :

(A) The centre of the wall thickness

(B) The outer radius

(C) The inner radius

(D) Both inner and outer radii

34. An open coiled helical spring of mean diameter d is subjected to an axial force P. The wire of the spring is subjected to :

(A) Direct shear stress only

(B) Combined shear and bending only

(C) Combined shear, bending and twisting

(D) Combined shear and twisting only

35. The maximum distortion energy theory of failure is suitable to predict the failure of one of the materials is :

(A) Brittle material

(B) Ductile material

(C) Plastics

(D) Composite materials

36. The effect of a force on a body depends on its :

(A) Direction

(B) Magnitude

(C) Position

(D) All of these

37. Two identical circular rods made of cast iron and mild steel are subjected to same magnitude of axial force. The stress developed is within proportional limit. Which of the following observation is correct ?

(A) Both rods elongate by same amount

(B) MS rod elongates more

(C) CI rod elongates more

(D) Both stress and strain are equal in both rods

38. A beam is said to be of uniform strength, if :

(A) The bending moment is same throughout the beam

(B) The shear stress is same throughout the beam

(C) The deflection is same throughout the beam

(D) The bending stress is same at every section along with its longitudinal axis

39. The point of contra flexure is a point where :

(A) Shear force changes sign

(B) Bending moment changes sign

(C) Shear force maximum

(D) Bending moment is maximum

40. A cantilever beam of length L, moment of inertia I and Young modulus E carries a concentrated load W at the middle of its length. The slope of cantilever at the free end is :

(A) (WL ^ 2)/2EI

(B) (WL ^ 2)/4EI

(C) (WL ^ 2)/8EI

(D) (WL ^ 2)/16EI

41. In a cantilever beam, if the length is doubled while keeping the cross section and concentrated load acting at the free end is same, the deflection at the free end will increase by :

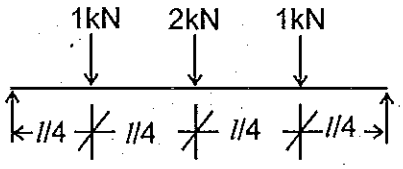
(A) 2.66 times

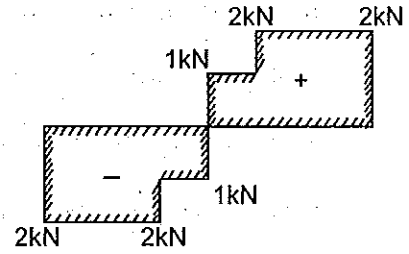
(B) 3 times

(C) 6 times

(D) 8 times

42. The shear force diagram for the given simply supported beam is :



(A)


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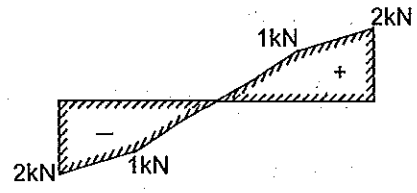

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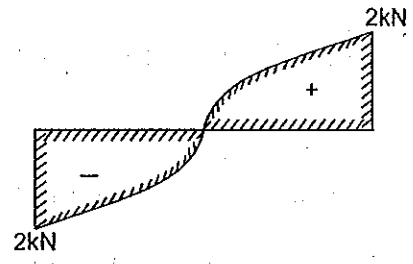

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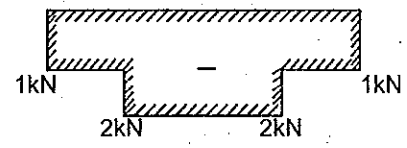

43. The strength of a hollow shaft for the same length, material and weight is _____ a solid shaft.

(A) Less than

(B) More than

(C) Equal to

(D) None of these

44. For a linearly elastic, isometric and homogeneous material, the number of elastic constants required to relate stress and strain are :

(A) Four

(B) Two

(C) Three

(D) Six

45. Slenderness ratio for any column is :

(A) Total length of the column/ Average area of cross-section of the column

(B) Height/weight of the column

(C) Effective length of the column/ modulus of elasticity

(D) Effective length of the column/ least radius of gyration

46. Among the following characteristics, one is NOT the characteristic of austenitic stainless steel :

(A) Toughness

(B) Corrosion resistance

(C) Birttleness

(D) Resilience

47. Corrosion resistance of stainless steel is due to :

(A) Chromium

(B) Carbon

(C) Vanadium

(D) Copper

48. Work hardening of a steel component reduces :

(A) Malleability

(B) Hardness

(C) Ductility

(D) Toughness

49. Galvanizing is done with a thin layer of :

(A) Zinc

(B) Copper

(C) Lead

(D) Silver

50. Bronze used for church bells contain :

(A) No copper

(B) 4 to 8% of tin

(C) 1 to 4% of tin

(D) 15 to 25% of tin

51. For removing thermally induced stresses in glasses, one of the following processes will be used :

(A) Annealing

(B) Tempering

(C) Hardening

(D) Cold working

52. Carbon-carbon composites are extensively used at :

(A) A very low temperature applications

(B) Room temperatures

(C) Temperatures around 3000°C

(D) Around 300°C

53. (111) plane of a cube is :

(A) Vertical

(B) Horizontal

(C) Inclined to HP

(D) Inclined to both HP and VP

54. The ability of a metal to withstand elongation or bending is known as :

(A) Ductility

(B) Malleability

(C) Stiffness

(D) Brittleness

55. Addition of Magnesium to cast iron increases its :

(A) Hardness

(B) Ductility

(C) Corrosion resistance

(D) Creep strength

56. Which of the following has least percentage of carbon ?

(A) Malleable cast iron

(B) Pig iron

(C) Stainless steel

(D) Wrought iron

57. Cementite contains C to the tune of :

(A) 0.6%

(B) 5%

(C) 3.6%

(D) 6.6%

58. The atomic bond found in diamond is :

(A) Ionic

(B) Covalent

(C) Metallic bond

(D) None of these

59. White metal is an alloy of :

(A) Lead + Tin

(B) Lead + Bismuth

(C) Lead + Zinc

(D) Lead + Aluminum

60. Which of the following generally made of High carbon steel ?

(A) Hammers

(B) Angle iron

(C) Solid drawn tubes

(D) Boiler plates

61. Connecting rod is generally manufactured by :

(A) Casting

(B) Drop forging

(C) Machining

(D) Upset forging

62. Honing opertion is used for high finish :

(A) For a plane surface

(B) Inside a cylindrical surface

(C) Outside cylindrical surface

(D) Not a surface finish operation

63. Jigs are not used in one of the following :

(A) Location

(B) Clamping of the component

(C) Safety

(D) None of these

64. Discontinuous chips occur in case of :

(A) Ductile materials

(B) Plastics

(C) Composites

(D) Brittle materials

65. For proper cutting, cutting materials does not require _____.

(A) Higher hardness

(B) Hot hardness

(C) High wear resistance

(D) High friction

66. Green sand contains :

(A) 15-24% of clay

(B) 50% of clay

(C) 5-8% of clay

(D) No clay

67. Hot tears results in castings due to :

(A) Too much shrinkage of molten metal

(B) High content of sulfur in molten metal

(C) Less moisture in mould

(D) Both (A) and (B)

68. Which of the following materials requires the largest shrinkage allowance, while making a pattern for casting ?

(A) Cast iron

(B) Brass

(C) Aluminum

(D) Plain carbon steel

69. Coal dust is added to moulding sounds for improving of the casing :

(A) Surface finish

(B) Collapsibility

(C) Hot strength

(D) Dry strength

70. In submerged arc welding, an arc is produced between :

(A) Carbon electrode and the workpiece

(B) Metal electrode and the workpiece

(C) Bare metal electrode and the workpiece

(D) Two tungsten electrodes and the work

71. When the tool moves parallel to the lathe axis, it is called :

(A) Cross feed

(B) Sellars' taper

(C) Chapman's taper

(D) Brown and Sharpe taper

72. In orders to grind soft material :

(A) Fine grained grinding wheel is used

(B) Medium grained grinding wheel is used

(C) Coarse grained grinding wheel is used

(D) None of these

73. A mandrel is used to hold :

(A) An eccentric work

(B) A heavy work

(C) A thin work

(D) None of these

74. The oxy-acetylene gas used in gas welding produces a flame temperature of :

(A) 1800°C

(B) 2100°C

(C) 2400°C

(D) 3200°C

75. Match the following manufacturing processes with the manufactured products :

(a) Investment casting	(1) Turbine rotors
(b) Die casting	(2) Turbine blades
(c) Centrifuged casting	(3) Connecting rods
(d) Drop forging	(4) GI pipes
(e) Extrusion	(5) CI Pipes
(f) Shell moulding	(6) Carburettor body

(A) 1, 6, 5, 3, 2, 4

(B) 1, 6, 5, 3, 4, 2

(C) 6, 1, 5, 3, 2, 4

(D) 1, 6, 3, 5, 4, 2

76. Assignable variables in statistical quality control results in :

(A) Proper sequencing of operations

(B) Improper operation of the machine

(C) Proper instruments used for inspection

(D) None of these

77. One of the groups is not part of quality circle :

(A) Leaders

(B) Management

(C) Facilitators

(D) Bankers

78. One of the following is a drawback in hydraulic drives :

(A) Drive is smooth

(B) Effect of temperature on oil viscosity

(C) Self-lubricating system

(D) Faster and reverse without shock

79. Which of the following statements is correct ?

(A) When slack of an activity is zero, it falls only on critical path

(B) CPM technique is useful to minimise the direct and indirect expenses

(C) Critical path of a network represents the minimum time required for completion of project

(D) All of these

80. Product layout is best suited when :

(A) One type of product is produced

(B) Product is standardized

(C) Product is manufactured in large quantities

(D) All of these

81. The chart that gives an estimate about the amount of materials handled between various work stations is known as :

(A) Flow chart

(B) Process chart

(C) Travel chart

(D) Operation chart

82. Purpose of Scheduling is to :

(A) Prescribe the sequence of operations to be followed

(B) Determine the programme for the operations

(C) Regulate the progress of job through various processes

(D) All of these

83. Acceptance sampling is used in :

(A) Job Production

(B) Batch Production

(C) Mass Production

(D) All of these

84. Gantt chart is used for :

(A) Inventory Control

(B) Material Handling

(C) Production Schedule

(D) Machine Repair Schedule

85. Job evaluation is the method of determining the :

(A) Relative values of a job

(B) Worker's performance on job

(C) Value of overall production

(D) Worth of the machine.

86. The aim of value engineering is to :

(A) Find the depreciation value of a machine

(B) Determine the selling price of a product

(C) Minimise the cost without change in quality of the product

(D) All of these

87. Simplex method is used for :

(A) Value Analysis

(B) Network Analysis

(C) Queuing Theory

(D) Linear Programming

88. The type of material handling equipment used for handling materials during manufacture of cement is :

(A) Bucket conveyor

(B) Belt conveyor

(C) Fork lift

(D) Overhead crane

89. Direct Expenses include :

(A) Factory Expenses

(B) Selling Expenses

(C) Administrative Expenses

(D) None of these

90. A critical activity has :

(A) Maximum slack

(B) Zero slack

(C) Minimum slack

(D) Average slack

SPACE FOR ROUGH WORK


SEAL