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

COMBINED COMPETITIVE (PRELIMINARY) EXAMINATION, 2010

Serial No. | | **MECHANICAL ENGINEERING**
Code No. 14

A

Time Allowed : Two Hours | ***Maximum Marks : 300***

INSTRUCTIONS

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.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C OR D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE RESPONSE SHEET.
3. You, have to enter your Roll Number on this Test Booklet in the Box provided alongside.
   Do NOT write *anything* else on the Test Booklet.

   Your Roll No. _____
4. This Booklet contains 120 items (questions). Each item comprises *four* responses (answers). You will select *one* response which you want to mark on the Response Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each item.
5. In case you find any discrepancy in this test booklet in any question(s) or the Responses, a written representation explaining the details of such alleged discrepancy, be submitted within three days, indicating the Question No(s) and the Test Booklet Series, in which the discrepancy is alleged. Representation not received within time shall not be entertained at all.
6. You have to mark all your responses ONLY on the separate Response Sheet provided. *See directions in the Response Sheet*.
7. All items carry equal marks. Attempt ALL items. Your total marks will depend only on the number of correct responses marked by you in the Response Sheet.
8. Before you proceed to mark in the Response Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Response Sheet as per instructions sent to you with your Admit Card and Instructions.
9. While writing Centre, Subject and Roll No. on the top of the Response Sheet in appropriate boxes use **"ONLY BALL POINT PEN".**
10. After you have completed filling in all your responses on the Response Sheet and the examination has concluded, you should hand over to the Invigilator only the Response Sheet. You are permitted to take away with you the Test Booklet.

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

ROUGH WORK

1. During tightening of the nut on a bolt, the stress induced in the bolt is :

(A) Compressive (B) Tensile

(C) Shear (D) Bending

2. The highest stress that a material can withstand for a specific length of time without excessive deformation is called :

(A) Fatigue strength (B) Endurance strength

(C) Creep rapture (D) Creep strength

3. Maximum shear stress theory gives better results for :

(A) Brittle material (B) Ductile material

(C) Both (A) & (B) (D) None of these

4. If the diameter of a circular section is doubled its deflection is reduced by :

(A) 16 times (B) 8 times

(C) 4 times (D) 2 times

5. Which of the following materials is highly elastic ?

(A) Brass (B) Steel

(C) Rubber (D) Cast Iron

6. Maximum slope of a cantilever of length 6 m carrying load at a distance of 4 m from fixed end is _____.

(A) Fixed end (B) Under the load

(C) Free end (D) Can't predict

7. Two shafts of same length & materials are joined in series. If the ratio of their diameter is 2, then the ratio of their angle of twist will be :

(A) 2 (B) 4

(C) 8 (D) 16

8. The ratio of average shear stress to the maximum shear stress in a beam with a square cross section is :

(A) 2 (B) 1.5

(C) 2/3 (D) 1

9. The normal stress at a point are 6x = 10 M Pa and 6y = 2 M Pa and the shear stress at this point is 3 M Pa. The maximum principal stress at this point is :

(A) 16 M Pa (B) 14 M Pa

(C) 11 M Pa (D) 20 M Pa

10. Tensile fracture in case of mild steel is :

(A) Cup and Cone type (B) Fibrous type

(C) Star type (D) Granular type

11. The shape of the bending moment diagram for a uniform cantilever carrying a uniformly distributed over its length is :

(A) Straight line (B) Hyperbola

(C) An ellipse (D) A parabola

12. The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to internal hydrostatic pressure is :

(A) 2 (B) 0.5

(C) 1 (D) 4

13. A hunting governor is :

(A) More sensitive (B) More stable

(C) Less sensitive (D) None of these

14. The maximum fluctuation of energy in flywheel is equal to :

(A) $I w (w_1 - w_2)$ (B) $I w^2 C_S$

(C) $2 E C_S$ (D) All of these

15. When the axis of the first and last gear are co-axial, then gear train is known as :

(A) Reverted gear train (B) Epicyclic gear train

(C) Compound gear train (D) Simple gear train

16. The module of a spur gear is defined as :

(A) $\frac{\pi d}{z}$ (B) $\frac{d}{z}$

(C) $\frac{z}{d}$ (D) $\frac{z}{\pi d}$

17. The maximum power to be transmitted by the belt drive, the ratio of centrifugal tension to permissible tension is :

(A) 3 (B) 2

(C) 0.5 (D) $\frac{1}{3}$

18. When two shafts are neither intersecting, power can be transmitted by using :

(A) A pair of spur gears (B) A pair of helical gears

(C) An Oldham's coupling (D) A pair of spiral gears

19. The tooth profile most commonly used in gear drive for power transmission is :

(A) A cycloid (B) An involute

(C) An ellipse (D) A parabola

20. The moment of intertia of Flywheel is 200 kg m^2 starting from rest it is moving with a uniform acceleration of 0.5 rad/sec^2. after 10 seconds from start, its kinetic energy will be :

(A) 250 N-m (B) 500 N-m

(C) 5000 N-m (D) 25000 N-m

21. If $w/w_n = \sqrt{2}$ where w is the frequency of excitation and w_n is the natural frequency of vibration, then the transmissibility of vibration will be :

(A) 0.5 (B) 1.0

(C) 1.5 (D) 2.0

22. Logarithmic decrement of a damped single degree of freedom system is δ. If stiffness of the spring is doubled and the mass is made half, then the logarithmic decrement of the system will be equal to :

(A) $\delta/4$ (B) $\delta/2$

(C) δ (D) 2δ

23. Hammer blow occurs when the centre of gravity of the balanced weight is :

(A) Directly above the wheel centre

(B) Directly below the wheel centre

(C) Directly above or below the wheel centre

(D) Perpendicular to the wheel vertical plane

24. Balancing of a rigid rotor can be achieved by approximately using balancing weight is :

(A) A single plane (B) Two planes

(C) Three planes (D) Four planes

25. The resultant of two equal forces is equal to either of them. The angle between the forces is :

(A) 120^o (B) 90^o

(C) 60^o (D) zero

26. Dimensions for moment of momentum are :

(A) $M L^2 T^{-1}$ (B) $M T^{-1}$

(C) $M L^2 T^{-3}$ (D) $M T^{-3}$

27. When a bullet is fired from a gun, it is coiled in the backward direction, it is due to :

(A) Impulse (B) Inertia

(C) Conservation of momentum (D) None of these

28. For perfectly elastic bodies the value of coefficient of restitution is :

(A) 1 (B) 0.5 to 1

(C) 0 to 0.5 (D) zero

29. The co-ordinate of the initial and terminal points of vector are (3, 1, – 2) and (4, – 7, 10). The magnitude of vector is approximately :

(A) 50 units (B) 8.1 units

(C) 14.5 units (D) 19.0 units

30. A projectile will cover the maximum vertical distance in a minimum time when the angle of projection is :

(A) 30^o (B) 45^o

(C) 60^o (D) 90^o

31. A body of weight 600 N is placed on a horizontal surface which tend to move when a horizontal force of $200\sqrt{3}$ N is applied. The angle of friction is :

(A) 30^o (B) 45^o

(C) 60^o (D) 90^o

32. Two particles with masses in the ratio 1 : 4 are moving with kinetic energies. The magnitude of their linear momentum will conform to the ratio :

(A) 1 : 8 (B) 1 : 2

(C) $\sqrt{2}:1$ (D) 4 : 1

33. Which of the following physical quantity is not a vector ?

(A) mass (B) momentum

(C) impulse (D) acceleration

34. Time acceleration graph of a body moving with uniform acceleration is a straight line :

(A) Passing through the origin (B) Inclined to time axis

(C) Parallel to time axis (D) Parallel to acceleration axis

35. Which of the following is intermetallic compound ?

(A) Ferrite (B) Austentite

(C) Pearlite (D) Cunentite

36. Machine tool guide ways are generally hardened by :

(A) Flame hardening (B) Vacuum hardening

(C) Induction hardening (D) Martempering

37. In oxy-acetylene gas welding for Complete Combustion the volume of oxygen required per unit acetylene is :

(A) 1.0 (B) 1.5

(C) 2 (D) 2.5

38. Single point thread cutting tool should ideally have :

(A) Zero rake (B) Positive rake

(C) Negative rake (D) None of these

39. Which of the following casting is not suitable for heat treatment ?

(A) Low carbon steel (B) Medium carbon steel

(C) High carbon steel (D) High speed steel

40. The approximate variation of the tool life exponent 'n' of cemented carbide tool is :

(A) 0.03 to 0.08 (B) 0.08 to 0.20

(C) 0.2 to 0.48 (D) 0.48 to 0.70

41. Feed drives in CNC milling machines are provided by :

(A) Synchronous motor (B) Induction motor

(C) Stepper motor (D) Servometer

42. Which of the following is a non-traditional machining method ?

(A) milling (B) drilling

(C) grinding (D) ultrasonic machining

43. Which of the following operation can produce a seamless tube ?

(A) Rolling (B) Blanking

(C) Piercing (D) Embossing

44. What is the correct sequence of the following parameters in order of their maximum to minimum influence on tool life ?

(i) Feed rate (ii) Depth of cut

(iii) Cutting speed

(A) (iii) , (i), (ii) (B) (i), (ii), (iii)

(C) (iii), (ii), (i) (D) (ii), (iii), (i)

45. 10 kg of air at 800 kPa are heated at a constant pressure from 450 K to 680 K. The work required is nearest to :

(A) 524 KJ (B) 960 KJ

(C) 715 KJ (D) 660 KJ

46. Cyclic integral of this is zero :

(A) Work transfer (B) Heat transfer

(C) Temperature (D) Latent heat

47. It is not an extensive property :

(A) Volume (B) Pressure

(C) Energy (D) Entropy

48. This gas has maximum value of specific heat ratio γ :

(A) Oxygen (B) Helium

(C) Methane (D) Carbon-di-oxide

49. For real gases $C_p = C_v$ at :

(A) Critical temperature (B) Triple point

(C) Absolute zero temperature (D) All temperature

50. If the thermal efficiency of a Carnot engine is 1/5, the COP of a Carnot refrigerator is :

(A) 4 (B) 5

(C) 6 (D) 3

51. It does not change during a throttling process :

(A) Entropy (B) Enthalpy

(C) Specific volume (D) Volume

52. The exergy of an isolated system in a process :

(A) can never increase (B) can never decrease

(C) always remain constant (D) always positive

53. For specific limits for the maximum and minimum temperature, the ideal cycle with the lowest thermal efficiency is :

(A) Carnot (B) Otto

(C) Diesel (D) Dual

54. How do the pump work change when a simple Rankine cycle is modified with reheating ?

(A) increase (B) decrease

(C) remains same (D) none of these

55. Material handling is higher in case of :

(A) Process layout (B) Product layout

(C) Group layout (D) Fixed position layout

56. If the demand for an item is doubled and the ordering cost halved, the economic order quantity :

(A) remain unchanged (B) $\sqrt{2}$ x original value

(C) doubled (D) 0.5 x original value

57. For lifting heavy jobs in a shop use is made of :

(A) Conveyors (B) Overhead Crane

(C) Fork Lift (D) Hoist

58. Identify the chart which is used to determine the profit potential under varying conditions of output and cost :

(A) Gnatt chart (B) Travel chart

(C) Break even chart (D) Emerson chart

59. The incentive wage plan in which saving are expressed as a percentage of standard time is :

(A) Hasley plan (B) Bedanx plan

(C) Rowan plan (D) Lincon plan

60. The act of expanding the process production is referred as :

(A) routing (B) scheduling

(C) follow up (D) dispatching

61. Jobs going ahead of schedule are conveniently shown in :

(A) Pie chart (B) Bar chart

(C) Gnatt chart (D) SIMO chart

62. Average height of a man in motion study is taken as :

(A) 1.2 m (B) 1.4 m

(C) 1.6 m (D) 1.8 m

63. What describe therblig in micromotion study ?

(A) A symbol (B) A colour

(C) An activity (D) Standard symbol and colour

64. Which one of the following is not a work measurement technique ?

(A) Work supply (B) Simulation

(C) Time study (D) Analytical Estimation

65. Dynamic viscosity (μ) has the dimension as :

(A) $M\,L\,T^{-2}$ (B) $M\,L^{-1}\,T^{-1}$

(C) $M\,L^{-1}\,T^{-2}$ (D) $M\,L\,T^{-1}$

66. Resultant hydrostatic force acts through a point known as :

(A) Centre of gravity (B) Centre of buoyancy

(C) Centre of pressure (D) None of above

67. Pitot tube is used for the measurement of :

(A) Pressure (B) Flow

(C) Velocity at a point (D) Discharge

68. The range of coefficient of discharge (C_d) for venturimeter :

(A) 0.6 to 0.7 (B) 0.7 to 0.8

(C) 0.8 to 0.9 (D) 0.95 to 0.99

69. A boundary is known as hydrodynamically smooth if :

(A) $\frac{k}{\delta'} = 0.3$ (B) $\frac{k}{\delta'} > 0.3$

(C) $\frac{k}{\delta'} < 0.25$ (D) $\frac{k}{\delta'} = 6.0$

where k$\rightarrow$ average height of irregularity from the boundary and $\delta' \rightarrow$Thickness of Laminar-sub Layer.

70. The loss of pressure head for the laminar flow through pipe varies :

(A) as the square velocity (B) directly as the velocity

(C) as the inverse of the velocity (D) none of the above

71. Boundary layer separation takes place if :

(A) pressure gradient is zero (B) pressure gradient is positive

(C) pressure gradient is negative (D) none of these

72. The height of water column corresponding to a pressure equivalent of 750 mm of mercury :

(A) 10.2 m (B) 10 m

(C) 10.4 m (D) 10.6 m

73. Existence of velocity potential implies that the fluid flow is :

(A) steady (B) uniform

(C) irrotational (D) all of these

74. A fully developed laminar viscous flow through a circular tube has the ratio of maximum velocity to average velocity :

(A) 2.0 (B) 2.5

(C) 3 (D) 1.5

75. For laminar boundary layer over an entire length of flate plate, the drag coefficient C_D is given by :

(A) $\frac{1.328}{\sqrt{R_{eL}}}$ (B) $\frac{0.074}{(R_{eL})\,0.25}$

(C) $\frac{0.37}{(R_{eL})^{1.5}}$ (D) $\frac{0.455}{(R_{eL})^{2}}$

76. There is no geometrical distribution between the stream line, path line and streak line in case of :

(A) Laminar Flow (B) Uniform Flow

(C) Steady Flow (D) Irrotational Flow

77. Which liquid metal can be taken as the best conductor ?

(A) Tin (B) Mercury

(C) Bismuth (D) Sodium

78. A decrease in heat transfer coefficient over the surface of a pin :

(A) Decreases its effectiveness

(B) Increases its effectiveness

(C) Does not affect its effectiveness

(D) Its effectiveness will first increase and then decrease

79. The critical radius of insulation :

(A) $\frac{1s}{\sqrt{2Kh}}$ (B) $\frac{2K}{h}$

(C) $h/2K$ (D) 2 Kh

80. The ratio of heat flow from two walls of thickness ratio 1 : 2 and thermal conductivity ratio 3 : 1 for the same temperature difference on the two sides is :

(A) 5 : 1 (B) 6 : 1

(C) 2 : 3 (D) 3 : 2

81. The dimensional number relevant in transient heat conduction is :

(A) Grashof number (B) Weber number

(C) Fourier number (D) Reynold number

82. The Prandtl number for air is about :

(A) 0.1 (B) 0.7

(C) 1.7 (D) 1.0

83. With increase in flow velocity of fluid the boundary layer thickness will :

(A) decrease (B) increase

(C) does not change (D) first increase then decrease

84. Nusslet number is given by :

(A) $\mu C_p/K$ (B) $\frac{\mu K}{C_p}$

(C) $\frac{hL}{K}$ (D) h K/ L

85. The absorptivity of a freshly white washed wall is close to :

(A) 0.1 (B) 0.3

(C) 0.5 (D) 0.9

86. The radiation shape factor between two large parallel plates is :

(A) zero (B) 0.5

(C) 1.0 (D) 2.0

87. The LMTD of a counter flow condenser as compared to that of a parallel flow condenser will be :

(A) More (B) Less

(C) Approximately same (D) Exactly exact

88. For a condenser of NTU = 2 the effectiveness is :

(A) $1 - e^{-2}$ (B) $0.5\ (1 - e^{-4})$

(C) 0.667 (D) 1.5

89. If a Carnot refrigeration cycle is to have a COP of 5 the ratio of maximum temperature to minimum temperature in the cycle should be :

(A) 1.2 (B) 1.5

(C) 2.0 (D) 2.5

90. The refrigeration system of a passenger aircraft works on reversed :

(A) Brayton cycle (B) Atkinson cycle

(C) Carnot cycle (D) Otto cycle

91. Which part of the vapour compression refrigeration cycle produces the refrigeration effect ?

(A) Condenser (B) Evaporator

(C) Throttle valve (D) Compressor

92. Which is usually costliest item in a refrigeration system ?

(A) condenser (B) capillary tube

(C) compressor (D) evaporator

93. In a refrigeration cycle the effect of superheating on COP is :

(A) Decrease (B) Remains change

(C) Increase (D) None of these

94. A refrigerant with highest critical pressure is :

(A) Carbon-di-oxide (B) Ammonia

(C) Freon-11 (D) Freon-12

95. At the back of domestic refrigerator, the bank of tubes are :

(A) Evaporator tubes (B) Condenser tubes

(C) Refrigeration cooling tubes (D) Capillary tubes

96. In cooling towers, the drift loss is around :

(A) 20% (B) 5 to 10%

(C) 10 to 20% (D) 20 to 30%

97. The relative humidity during heating and humidification :

(A) Increases (B) Decreases

(C) May increase or decrease (D) Remains constant

98. The wet bulb temperature during sensible cooling will :

(A) Decrease (B) Remains constant

(C) Increases (D) Can't be predicted

99. In vapour absorption system lithium bromide is used as :

(A) Lubricant (B) Cooling substance

(C) Absorbent (D) Refrigerant

100. The colour of flame during halide torch test for refrigerant will change to :

(A) Grey (B) Blue or bright Green

(C) Black (D) Pink or Red

101. In a 4-cylinder petrol engine the standard firing order is :

(A) 1-2-3-4 (B) 1-4-3-2

(C) 1-3-2-4 (D) 1-3-4-2

102. The knocking tendency of the petrol engine will increase when :

(A) Speed is decreased (B) Speed is increased

(C) Fuel air ratio is made rich (D) Fuel air ratio is made lean

103. Cetane number is the measure of :

(A) Viscosity of fuel (B) Ignition quality

(C) Calorific value of fuel (D) Auto Ignition temperature

104. With which of the following engines term scavenging is associated ?

(A) Aero Engine (B) Diesel Engine

(C) High efficiency engines (D) None of these

105. An engine indicator is used to determine :

(A) temperature (B) m.e. p.

(C) speed (D) volume of the cylinder

106. Which one of the following types of compressor is mostly used for supercharging of I.C. Engines ?

(A) Radial flow compressor (B) Axial flow compressor

(C) Root blower (D) Reciprocating compressor

107. At constant efficiency horse power of a fan is :

(A) proposition to r.p.m (B) proportional to $(r.p.m)^2$

(C) proportional to $(r.p.m)^3$ (D) a polynomial function of r.p.m.

108. With an increase in compression ratio the volumetric efficiency of air compressor will :

(A) decrease (B) increase

(C) remains same (D) can't be predicted

109. For a jet propulsion unit, ideally the compressor and turbine work are :

(A) Equal (B) Unequal

(C) Not related to each other (D) Unpredictable

110. In a gas turbine cycle, the turbine output is 600 KJ/kg, the compressor work is 400 KJ/kg and the heat supplied is 1000 KJ/kg. The thermal efficiency of the cycle is :

(A) 80% (B) 60%

(C) 40% (D) 20%

111. The effect of supersaturation, in a nozzle is :

(A) to increase the heat drop (B) to increase entropy

(C) to decrease dryness fraction of steam (D) to decrease specific volume of steam

112. Reheat factor in steam turbine depends upon :

(A) exit pressure only (B) stage efficiency only

(C) initial temperature and pressure only (D) all of the above

113. For a given power an impulse turbine as compared to a reaction turbine has ___ row of blades :

(A) less (B) more

(C) equal (D) none of above

114. The pressure velocity compounding of steam turbine results in :

(A) More power output (B) Large number of stages

(C) Lesser friction losses (D) Shorter turbine for a given total pressure

115. For reaction turbines which of the following governing methods is not used ?

(A) Throttle governing (B) By-pass governing

(C) Nozzle control governing (D) Throttle and by pass governing

116. Which of the following surge tank is also called throttle surge tank ?

(A) Inclined surge tank (B) Expansion chamber surge tank

(C) Restricted orifice surge tank (D) None of the above

117. Kinematic similarity between model and prototype is the similarity of :

(A) Shape (B) Discharge

(C) Stream line pattern (D) Forces

118. If the specific speed of a turbine is more than 300, the type of turbine is :

(A) Pelton (B) Kaplan

(C) Francis (D) Pelton with more jets

119. Cavitation can take place in case of :

(A) Pelton wheel
(B) Centrifugal pump
(C) Reciprocating pump
(D) All of these

120. Main characteristics curves of turbine means :

(A) Curves at constant speed
(B) Curves at constant efficiency
(C) Curves at constant head
(D) None of the above

ROUGH WORK

ROUGH WORK