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Test Booklet Series

Serial No.

327

C

SCREENING TEST – 2006

SUBJECT : MECHANICAL ENGINEERING

Time Allowed : Two Hours

Maximum Marks : 120

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1. A system of three forces acts on a body and keeps it in equilibrium the forces need to be

- (a) coplanar only
- (b) concurrent only
- (c) coplanar as well as concurrent
- (d) coplanar but may or not be concurrent

2. The maximum velocity and maximum acceleration of a particle executing simple harmonic motion are 2 m/sec and 20 m/sec². The time period of motion equals

- (a) π
- (b) $\frac{\pi}{5}$
- (c) $\frac{\pi}{10}$
- (d) $\frac{\pi}{32}$

3. The number of links in a pantograph is

- (a) 3
- (b) 4
- (c) 5
- (d) 6

4. Centrifugal governors are preferred to inertia type governors because an inertia governors

- (a) has less controlling force
- (b) is highly sensitive and more prone to hunting
- (c) poses problems in the balancing of inertia forces
- (d) has high initial and maintenance cost

5. Which of the following drives is best suited for large velocity ratios?

- (a) chain drive
- (b) spur gear drive
- (c) helical gear drive
- (d) worm and worm wheel

6. For a shaft rotating inside a bearing of radius r , the radius of friction circle is equal to

- (a) r
- (b) $r \sin \phi$
- (c) $r \cos \phi$
- (d) $r \tan \phi$

where ϕ - friction angle.

7. The area under the stress-strain curve represents

- (a) breaking strength of material
- (b) toughness of material
- (c) hardness of material
- (d) energy required to cause failure

8. For a beam of length l , simply supported at its ends and carrying uniformly distributed load w per unit length, maximum bending moment occurs at the centre of beam and is given by

(a) $\frac{wl^2}{2}$

(b) $\frac{wl^2}{4}$

(c) $\frac{wl^2}{8}$

(d) $\frac{wl^3}{8}$

9. Stiffness of a material is expressed in terms of

(a) mass density

(b) hardness number

(c) modulus of elasticity

(d) impact strength

10. Suggest the welding process often used in joining rails

(a) thermal welding

(b) submerged arc welding

(c) thermit welding

(d) percussion welding

11. Which of the following has maximum thermal conductivity

(a) aluminium

(b) steel

(c) brass

(d) glass

12. L M T D in case of counter flow heat exchanger as compared to parallel flow heat exchanger is

(a) higher

(b) lower

(c) same

(d) depends on the area of the heat exchanger

13. Which of the following does *not* relate to a two stroke petrol engine

(a) flywheel

(b) fuel injector

(c) carburettor

(d) spark plug

14. In a boiler superheating of steam is done at

(a) constant volume

(b) constant temperature

(c) constant pressure

(d) constant entropy

15. An economiser in a boiler

(a) increases steam pressure

(b) increases steam flow

(c) decreases fuel consumption

(d) decreases boiler efficiency

16. In an air compressor, intercooling is done for the following effect

(a) to reduce the work input

(b) to reduce coolant temperature

(c) to increase cooling tower efficiency

(d) to increase the work input

17. While measuring the volume flow rate of air in a compressor, a drum is added to the system. The objective is
- to increase pressure
 - to increase mass flow
 - to increase swept volume
 - to reduce fluctuations
18. The suction pipe diameter of refrigerating unit compressor in comparison to delivery pipe diameter is
- larger
 - smaller
 - equal
 - dependant on capacity
19. Lithium bromide in vapour absorption refrigeration system is used as
- refrigerant
 - cooling substance
 - auxiliary refrigerant
 - absorbent
20. Air in Domestic Window Air Conditioner is dehumidified by
- heating
 - cooling
 - injecting water
 - injecting steam
21. Which of the following machines does *not* require quick return mechanism
- slotter
 - planer
 - shaper
 - broaching
22. Routing prescribes the
- flow of materials in the plant
 - proper utilization of man power
 - proper utilization of machines
 - both (b) and (c)
23. In which of the following layouts, the lines need to be balanced
- process layout
 - product layout
 - fixed position layout
 - plant layout
24. Process layout is employed for
- batch production
 - continuous production
 - effective utilization of machines
 - All of the above
25. 1 m^3 of air at a pressure of 100 N/cm^2 is allowed to expand freely to a volume of 10 m^3 . The work done will be
- zero
 - 10^6 N-m
 - $9 \times 10^5 \text{ N-m}$
 - none of these

26. Which of the following parameters remains constant during ideal throttling process

- (a) pressure
- (b) temperature
- (c) volume
- (d) enthalpy

27. Total heat of a substance is also known as

- (a) internal energy
- (b) entropy
- (c) thermal capacity
- (d) enthalpy

28. When a body floating in a liquid, is displaced slightly, it oscillates about

- (a) c.g. of the body
- (b) centre of pressure
- (c) centre of buoyancy
- (d) metacentre

29. Flow of water in a pipe about 3 m in diameter can be measured by

- (a) orifice plate
- (b) venturimeter
- (c) rotameter
- (d) pitot tube

30. Venturimeter is used to measure flow of fluids in pipes when the pipe is

- (a) horizontal
- (b) vertical
- (c) inclined
- (d) in any position

31. An elevator weighing 1 kN attains an upward velocity of 4 m/sec in 2 sec with uniform acceleration. The tension in the supporting cable will be

- (a) 1000 N
- (b) 800 N
- (c) 1200 N
- (d) 2000 N

32. If a body is having motion of translation as well as motion of rotation, then the total kinetic energy is given by

- (a) $\frac{1}{2}(m+I)v^2$
- (b) $\frac{1}{2}(m+I)\omega^2$
- (c) $\frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$
- (d) $\frac{1}{2}m(v^2 + \omega^2)$

33. Two pieces of steel and brass of mass 2 kg and 1 kg respectively fall freely under the action of gravity from a tower. After a distance, the following will be identical

- (a) acceleration
- (b) momentum
- (c) kinetic energy
- (d) potential energy

34. Two simply supported beams are of equal length, one carries a central load w and other carries a uniformly distributed load such that the total load is w . The ratio of maximum deflection in the two cases is

- (a) 8/5
- (b) 8/6

(c) 8/7

(d) 5/4

35. Hoop stress in a thin cylinder of diameter d and thickness t subjected to internal pressure p will be

(a) $pd/4t$

(b) pd/t

(c) $pd/2t$

(d) $2pd/t$

36. A beam of uniform strength is one in which

(a) bending moment is same throughout the beam

(b) deflection is same throughout the length

(c) the bending stress is same at every section

(d) shear stress is same throughout the beam

37. For 20° pressure angle involute profile, minimum number of teeth on pinion will be

(a) 6

(b) 12

(c) 17

(d) 20

38. The minimum number of teeth which can be cut for standard tooth for given pressure angle ϕ is equal to

(a) $2 \sin^2 \phi$

(b) $\frac{\sin^2 \phi}{2}$

(c) $\frac{2}{\sin^2 \phi}$

(d) $\frac{2}{\sin \phi}$

39. Blanking and piercing operations can be performed simultaneously in

(a) simple die

(b) progressive die

(c) compound die

(d) combination die

40. Tungsten content in High speed steel cutting tool material is about

(a) 16%

(b) 4%

(c) 0.1%

(d) 1%

41. External screw threads can be mass produced fastest by

(a) Milling

(b) Chasing

(c) Casting

(d) Rolling

42. Gray cast iron is best welded by
- TIG
 - Arc
 - MIG
 - Oxy-acetylene
43. The masses of two balls are in the ratio of 2 : 1 and their respective velocities are in the ratio of 1 : 2 but in the opposite direction before impact. If the coefficient of restitution is $\frac{1}{2}$, the velocities of separation of the balls will be equal to
- original velocity in the same direction
 - half of the original velocity in the same direction
 - half of the original velocity in the opposite direction
 - original velocity in the opposite direction
44. A body moves from rest with a constant acceleration of 5m/s^2 . The distance covered in 5 s is most nearly to
- 38 m
 - 62.5 m
 - 96 m
 - 124 m

45. When trying to turn a key into a lock, the following is applied
- coplanar force
 - non-coplanar forces
 - couple
 - moment
46. The ratio of heat flow Q_1/Q_2 from two walls of same thickness having their thermal conductivities as $K_1 = 2 K_2$ will be
- 1
 - 0.5
 - 2
 - 0.25
47. According to Stefan's law, the total radiation from a black body per second per unit area is proportional to
- absolute temperature (T)
 - T^2
 - T^3
 - T^4
48. Thermal conductivity of glass wool depends on
- porosity
 - density
 - both (a) & (b)
 - none of the above

49. The relation between Young's modulus (E) and bulk modulus (K) is given by

- (a) $E = K \left(1 - \frac{2}{m}\right)$
- (b) $E = K \left(1 + \frac{2}{m}\right)$
- (c) $E = K \left(1 - \frac{3}{m}\right)$
- (d) $E = K \left(1 + \frac{3}{m}\right)$

50. The shafts are designed for

- (a) strength
- (b) rigidity
- (c) both (a) and (b)
- (d) none of the above

51. Micromotion study is

- (a) enlarged view of motion study
- (b) analysis of only one stage of motion study
- (c) time study of small components up to microseconds
- (d) subdivision of an operation into therbligs and their analysis

52. Which one is not a therblig?

- (a) Use
- (b) Hold
- (c) Dispatch
- (d) Inspection

53. Value engineering for value analysis purposes is defined as

- (a) purchase value
- (b) saleable value
- (c) depreciated value
- (d) function/cost

54. Bernoulli's theorem is applicable for

- (a) Streamline flow
- (b) Steady flow
- (c) Turbulent flow
- (d) Perfect incompressible fluid flowing in continuous streams

55. In the case of steady flow of a fluid, the acceleration of any fluid particle is

- (a) Constant
- (b) Variable
- (c) Zero
- (d) Zero under limiting conditions

56. A pressure of 25 m. of head of water is equal to
- (a) 25 KN/m²
 - (b) 245 KN/m²
 - (c) 2500 KN/m²
 - (d) 2.5 KN/m²

57. When a gas is to be stored, the type of compression that would be ideal (maximum efficiency) is
- (a) adiabatic
 - (b) polytropic
 - (c) constant volume
 - (d) isothermal

58. Carnot cycle has maximum efficiency for
- (a) reversible engine
 - (b) irreversible engine
 - (c) diesel engine
 - (d) petrol engine

59. For polytropic process, the specific heat is given by the relation

$$C_n = C_v \frac{n-k}{(n-1)}$$

For $1 < n < K$, C_n will be

- (a) Zero
- (b) Positive
- (c) Infinite
- (d) Negative

60. In most high speed milling cutters, positive radial rake angle is
- (a) 2 - 6°
 - (b) 7 - 10°
 - (c) 10 - 15°
 - (d) 15 - 20°

61. Navier Stokes equations are associated with
- (a) Buoyancy
 - (b) Turbulence
 - (c) Viscosity
 - (d) Compressibility

62. Turbulence in flow implies
- (a) non-uniformity of flow
 - (b) unsteadiness of flow
 - (c) transition from laminar and turbulent flow
 - (d) random component of velocity superimposed on mean flow

63. The heat flow equation through a cylinder of inner radius r_1 and outer radius r_2 is desired to be written in the same form as that for heat flow through a plane wall. For wall thickness $(r_2 - r_1)$, the equivalent area A_m would be

(a) $\frac{A_1 + A_2}{2}$

(b) $\frac{A_1 + A_2}{2 \log_e \left(\frac{A_2}{A_1} \right)}$

(c) $\frac{A_2 - A_1}{\log_e \left(\frac{A_2}{A_1} \right)}$

(d) $\frac{A_1 + A_2}{2 \log_e \left(\frac{A_2}{A_1} \right)}$

64. An increase in convective coefficient over a fin

- (a) increases effectiveness
- (b) decreases effectiveness
- (c) does not influence effectiveness
- (d) influence only the fin efficiency

65. When a petrol engine is supplied with diesel fuel

- (a) the engine will not run
- (b) the engine will consume more fuel
- (c) the engine will operate with reduced output
- (d) the exhaust will have dense black smoke

66. In spark ignition engines, the possibility of knocking can be reduced by

- (a) increasing compression ratio
- (b) decreasing compression ratio
- (c) increasing the coolant temperature
- (d) advancing the spark timing

67. The term heating surface in a boiler means

- (a) area of grate
- (b) volume of furnace
- (c) outer surface area of boiler shell
- (d) surface area which is in contact with flue gases

68. The efficiency of Rankine cycle

- (a) increases with increase in exhaust pressure
- (b) increases with decrease in temperature of heat rejection
- (c) decreases with increase in temperature of heat rejection
- (d) is independent of temperature of heat rejection and exhaust pressure

69. A Bell Coleman cycle is a reversed

- (a) Brayton cycle
- (b) Atkinson cycle
- (c) Ericsson cycle
- (d) Carnot cycle

70. Which of the following type of compressor is generally used in domestic refrigerator

- (a) axial
- (b) centrifugal
- (c) mixed flow
- (d) piston type reciprocating

71. In orthogonal cutting, the cutting edge is perpendicular to
- direction of tool travel,
 - shear plane
 - direction of depth of cut
 - none of the above.
72. The metal removal during machining is by
- cutting
 - tearing
 - shearing
 - plastic distortion
73. The process of making hollow castings from permanent mould by a close fitting core is known as
- centrifugal casting
 - pressed casting
 - slush casting
 - lost wax casting
74. Greater flexibility in plant layout is achieved in case of
- process layout
 - product layout
 - group layout
 - fixed position layout

75. The break-even-point is least affected by
- product mix
 - selling price
 - fixed cost
 - volume of production
76. Routing and scheduling are integral part of
- product planning
 - work study
 - job analysis
 - quality control
77. The expression $\int p dV$ gives the measure of work done during
- steady flow reversible process
 - non-flow reversible process
 - open system and any process
 - any system and any process
78. Second Law of thermodynamics defines
- entropy
 - enthalpy
 - efficiency
 - internal energy

79. Which of the following is an irreversible cycle

- (a) Carnot
- (b) Stirling
- (c) All of the above
- (d) None of the above

80. Streamlines, streak lines, and path lines are all identical in case of

- (a) uniform flow
- (b) non-uniform flow
- (c) steady flow
- (d) rotational flow

81. In orthogonal cutting of metals the cutting edge is

- (a) perpendicular to the shear plane
- (b) perpendicular to the work piece
- (c) perpendicular to the direction of tool travel
- (d) none of the above

82. Process layout

- (a) allows variety of products to be made on the same equipment
- (b) is suitable for low volume variable demand
- (c) less equipment for general purpose and less expensive
- (d) All of the above

83. Chip breakers are used in cutting tools

- (a) increase tool life
- (b) provide smooth path for long chips
- (c) break the chips into short segments
- (d) All of the above

84. Broaching is used for machining

- (a) internal and external surfaces
- (b) rounding of irregular shaped holes
- (c) teeth of a gear

85. Taylor's philosophy of scientific management pays attention to

- (a) Conversion of inputs to desired outputs
- (b) Time management
- (c) Planning of the appropriate manpower
- (d) Motion economy principles

86. A soldering operation was work sampled over two days (16 hours) during which an employee soldered 108 joints. Actual working time was 90% of the total time and the performance rating estimated to be 120%. If the contract provides allowance of 20% of the total time available the standard time for the operation would be

- (a) 12 min
- (b) 8 min
- (c) 9 min
- (d) 10 min

87. A tool signature comprises of

- (a) 5 elements
- (b) 6 elements
- (c) 7 elements
- (d) 8 elements

88. While machining which of the following improves surface finish

- (a) Increased depth of cut
- (b) Increased cutting speed
- (c) Increased feed rate
- (d) Formation of built-up-edge

89. Break-even point increases with

- (a) increase in fixed cost
- (b) increase in variable cost for a given value of price
- (c) decrease in unit contribution
- (d) All of the above

90. Thermit welding differs from other methods of welding in the following way

- (a) It does not use heating
- (b) It employs exothermic chemical reaction for developing high temperature
- (c) It takes less time
- (d) It does not require electrodes

91. One poise is equal to

- (a) $1 \text{ Ns}/\text{m}^2$
- (b) $0.5 \text{ Ns}/\text{m}^2$
- (c) $0.1 \text{ Ns}/\text{m}^2$
- (d) $0.01 \text{ Ns}/\text{m}^2$

92. If N_1 and N_2 are maximum and minimum equilibrium speeds, then sensitiveness of governor will be

- (a) $\frac{N_1 + N_2}{2N_1}$
- (b) $\frac{N_1 + N_2}{2N_2}$
- (c) $\frac{N_1 - N_2}{N_1 + N_2}$
- (d) $\frac{N_1 - N_2}{2(N_1 + N_2)}$

93. A projectile is fired at an angle α , such that its horizontal range is 500 m.

What is the angle α if the maximum horizontal range of the projectile is 1000 m

- (a) 60°
- (b) 45°
- (c) 22.5°
- (d) 15°

94. When the governor is over sensitive, the sleeve will oscillate between two extreme positions on slight change of speed. The governor is said to be

- (a) isochronous
- (b) stable
- (c) unstable
- (d) hunting

95. A bullet leaves the muzzle of a gun with a velocity of 400 m/sec. Assuming constant acceleration from starting point to muzzle, what is the time taken by the bullet to travel a distance of 1 m through the gun barrel.

- (a) 0.2 second
- (b) 0.5 second
- (c) 0.005 second
- (d) None of these

96. For two springs having same stiffness (k) are in parallel, the equivalent stiffness would be

- (a) $\frac{k}{4}$
- (b) $\frac{k}{2}$
- (c) k
- (d) $2k$

97. A man falling from a height ' h ' starts rotating midway of his fall. The vertical velocity with which the man will touch the ground will be

- (a) $\sqrt{2gh}$
- (b) less than $\sqrt{2gh}$
- (c) greater than $\sqrt{2gh}$
- (d) less or more but never equal to $\sqrt{2gh}$

98. Which of the following metals has the lowest melting point

- (a) Aluminium
- (b) Silver
- (c) Zinc
- (d) Tin

99. Die casting is generally *not* used for

- (a) Zinc base alloys
- (b) Aluminium base alloys
- (c) Non-ferrous metals
- (d) Cast Iron

100. Lathe bed is made up of

- (a) Mild steel
- (b) Cast steel
- (c) Close grain Cast Iron
- (d) Pig Iron

101. S. I. unit of viscosity is

- (a) 10 times poise
- (b) 9.81 times poise
- (c) equal to poise
- (d) None of the above

102. A mercury-water manometer indicates a gauge difference of 400 mm. The difference in pressure, measured in meters of water is

- (a) 0.4
- (b) 0.8
- (c) 10.80
- (d) 5.04

103. A most economical channel section is one which for a given cross-sectional area

- (a) has maximum velocity of fluid
- (b) has maximum discharge
- (c) has maximum depth of fluid flowing
- (d) has maximum wetted perimeter

104. The centre of gravity of the volume of liquid displaced by an immersed body is called

- (a) Metacentre
- (b) Centre of buoyancy
- (c) Centre of pressure
- (d) Wet centre

105. Multistage centrifugal pumps are used

- (a) To produce high heads
- (b) To give high discharge
- (c) Both (a) & (b) together
- (d) To pump highly viscous fluids

106. The purpose of surge tank in a pipeline is to

- (a) Smoothen the flow of water
- (b) Minimise friction losses in pipe
- (c) Prevent occurrence of hydraulic jump
- (d) To relieve the pressure due to water hammer

107. The speed of a submarine can be measured by

- (a) Pitot tube
- (b) Hotwire anemometer
- (c) Pirani gauge
- (d) Any of the above

108. A disc of moment of inertia I_1 is mounted on a shaft of moment of inertia I_2 . What is the natural frequency of torsional vibrations, if torsional rigidity of shaft is q

- (a) $\frac{1}{2\pi} \sqrt{\frac{q}{I_1}}$
- (b) $\frac{1}{2\pi} \sqrt{\frac{q}{I_2}}$
- (c) $\frac{1}{2\pi} \sqrt{\frac{3q}{3I_1 + I_2}}$
- (d) $\frac{1}{2\pi} \sqrt{\frac{q}{I_1 + I_2}}$

109. The moments of inertia of a solid circular section of radius r and of a hollow circular section of radii r and R , each about their diametral axes are equal, then
- $R = 2r$
 - $R = 1.414r$
 - $R = 1.189r$
 - R is nearly equal to r
110. The speed variations of the engine during a cycle for constant output load is reduced by a
- D-slide valve
 - Governor
 - Flywheel
 - Mayer's expansion valve
111. The design of thin cylindrical shells is based on
- hoop stress
 - longitudinal stress
 - volumetric stress
 - average of hoop and longitudinal stress
112. Deflection in a beam is maximum where the slope is
- Minimum
 - Maximum
 - Zero
 - Changes sign
113. The inlet valve of a four stroke cycle I.C. engine remains open for nearly
- 180°
 - 125°
 - 235°
 - 200°
114. The capacity of a compressor is $5 \text{ m}^3 / \text{min}$ refers to
- Standard air
 - Free air
 - Compressed air
 - Compressed air at delivery pressure
115. The refrigerant for a refrigerator should have
- high sensible heat
 - high total heat
 - high latent heat
 - low latent heat
116. Super heating in a refrigeration cycle
- increases Cop,
 - decreases Cop
 - Cop remains unaltered
 - other factors decide Cop

117. The Cop of a vapour compression plant in comparison to vapour absorption plant is

- (a) more
- (b) less
- (c) same
- (d) more / less depending on size of plant

118. On psychrometric chart, wet bulb temperature lines are

- (a) horizontal
- (b) vertical
- (c) straight inclined sloping downward to the right
- (d) curved

119. Heating and dehumidification can be achieved simultaneously if air is passed through

- (a) sprays of water maintained at a temperature higher than the dew point temperature of the entering air
- (b) a solid absorbent surface
- (c) a liquid absorbent spray
- (d) any one of the (b) and (c)

120. Dew point temperature is always an indication of

- (a) dryness of air
- (b) latent heat
- (c) moisture content of the air
- (d) coolness of air