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Booklet Series

A

Booklet No.

228537

QUESTION BOOKLET

SECOND PAPER

MECHANICAL ENGINEERING (03)

Time Allowed : 2 Hours **Maximum Marks : 200**

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Series - **A**

1. For an ideal gas, enthalpy is represented by

(A) $H = U - RT$

(B) $H = U + RT$

(C) $H = RT - U$

(D) $H = -(U + RT)$

2. In a steady flow process, across the control volume mass and energy flow

(A) Varies continuously

(B) Remain constant

(C) Depends on control surface

(D) Depends on type of process

3. A polytropic process with $n = -1$, initiates with $P = V = 0$ and ends with $P = 600$ kPa and $V = 0.01\ m^3$. The work done is

(A) 2 kJ

(B) 3 kJ

(C) 4 kJ

(D) 6 kJ

4. A thermal reservoir is a body of

(A) Small heat capacity

(B) Large heat capacity

(C) Infinite heat capacity

(D) Large work capacity

5. Gas turbines are preferred in aircraft propulsion, due to

(A) They are heavy.

(B) They have low power to weight ratio.

(C) They have high power to weight ratio.

(D) They are efficient.

6. Ammonia has a boiling point of

(A) – 33.3 °C

(B) – 43.3 °C

(C) – 53.3 °C

(D) – 63.3 °C

7. If the pressure range of compressor is low, then the COP will be

(A) low

(B) high

(C) remains unchanged

(D) Cannot be determined.

8. The convective heat transfer coefficient does not depend on

(A) surface type

(B) surface orientation

(C) surface material

(D) surface area

9. Among the following, the best insulator is

(A) Air

(B) Water

(C) Ash

(D) Aluminium

10. During steady state heat transport in a thin plate with uniform temperature, the nature of temperature distribution is

(A) Parabolic

(B) Logarithmic

(C) Linear

(D) Exponential

11. A long conduit of 4 cm outer diameter is carrying steam. Currently it is insulated with 20 mm thick insulation. Additional insulation required to reduce the heat loss by two-third is

(A) 90 mm

(B) 110 mm

(C) 120 mm

(D) 140 mm

12. For an infinitely long fin, efficiency is given by

(A) $\frac{1}{mL}$

(B) $\frac{2}{mL}$

(C) $\frac{1}{2\,mL}$

(D) $\frac{3}{mL}$

13. In lumped capacity heat transfer model, the variation of temperature with time is

(A) Linear

(B) Parabolic

(C) Exponential

(D) Hyperbolic

14. The ratio between emissive power and intensity of normal radiation is

(A) π

(B) $\pi/2$

(C) $2/\pi$

(D) $\pi/3$

15. In what form solar energy is radiated from the Sun ?

(A) Ultraviolet radiation

(B) Infrared radiation

(C) Electro-magnetic waves

(D) Transverse waves

16. Two infinite parallel plates are kept at a distance, Y. The value of shape factor is

(A) zero

(B) one

(C) Y

(D) Infinity

17. A solar thermal operated vapour absorption system is capable of

(A) Continuous operation.

(B) both continuous and intermittent operation.

(C) No operation.

(D) Intermittent operation.

18. For an incompressible fluid, the density

(A) Varies with temperature only.

(B) Varies with pressure only.

(C) Varies with both pressure and temperature.

(D) Remain constant.

19. In a flow field, streamlines and equipotential lines are

(A) Parallel to each other.

(B) Perpendicular to each other.

(C) Intersect each other at acute angle.

(D) Intersect at obtuse angle.

20. Newtonian fluids are the one which

(A) Obeys Newton's law of viscosity.

(B) Obeys Hook's law.

(C) Obeys Williamson's law.

(D) Obeys Power law.

21. Which fluid does not experience stress during flow ?

(A) Dilatant

(B) Bingham

(C) Viscoplastic

(D) Inviscid

22. A beaker contains water upto h height. The location of centre of pressure is

(A) h/3 from top

(B) h/2 from top

(C) 2h/3 from top

(D) 3h/4 from top

23. Which one of the following is not a case of ideal fluid flow ?

(A) Inviscid

(B) Incompressible

(C) Forced vortex flow

(D) Super critical flow

24. For an inclined plane for which position, maximum total pressure acts on it ?

(A) Horizontal

(B) Vertical

(C) Skewed

(D) Inclined

25. Which one of the following is an example of magneto fluids ?

(A) Alcohol

(B) Water

(C) Liquid metal

(D) Ethylene Glycol

26. Which one of the following needs maximum head ?

(A) Kaplan turbine

(B) Pelton turbine

(C) Francis turbine

(D) Reaction turbine

27. Power delivered in Pelton turbine is given by

(A) $W(V_{w1} + V_{w2})\frac{u}{g}$

(B) $W(V_{w1} - V_{w2})\frac{u}{g}$

(C) $(V_{w1} - V_{w2})\frac{u}{g}$

(D) $(V_{w1} + V_{w2})\frac{u}{g}$

28. Generally runner blades are made of

(A) Cast Iron

(B) Cast Steel

(C) Mild Steel

(D) High Carbon Steel

29. The inlet passage of water entry in a hydraulic turbine is controlled by

(A) Gate

(B) Head race

(C) Tail race

(D) Pum

30. Which one is a major advantage of centrifugal pump ?

(A) Cost is low.

(B) Efficiency is high.

(C) Construction is simple.

(D) Ease in use.

31. Number of valves required to operate the rotary pump :

(A) 4

(B) 3

(C) 2

(D) zero

32. Hydraulic gradient line represents the sum of

(A) Datum head and Pressure head

(B) Datum head and Kinetic head

(C) Pressure head and Kinetic head

(D) Pressure, Datum and Kinetic head

33. In a locomotive boiler, the shell length is

(A) 2 m

(B) 3 m

(C) 4 m

(D) 5 m

34. What should be pH value of water used in boilers ?

(A) 0

(B) 7

(C) less than 7

(D) more than 7

35. Which of the following is an example of externally fired boiler ?

(A) Lancashire boiler

(B) Cochran boiler

(C) Babcock and Wilcox boiler

(D) Scotch Marine boiler

36. Major loss of energy in a typical power plant takes place in

(A) Condenser

(B) Pump

(C) Boiler

(D) Turbine

37. What is the critical point of steam generation in a 'once through' boiler ?

(A) 211.2 bar

(B) 221.2 bar

(C) 231.2 bar

(D) 241.2 bar

38. The motion between a pair which takes place in _____ is known as incompletely constrained motion.

(A) One direction only

(B) Two directions only

(C) More than one direction

(D) None of these

39. A typewriter mechanism has six links, seven binary joints and no higher pairs. This mechanism could be

(A) unsound in kinematics

(B) sound in kinematics

(C) It depends on fixed links.

(D) Cannot say anything.

40. If shaft angle in 'θ' and friction angle in 'ϕ', maximum efficiency of spiral gear will be

(A) $\sin(\theta + \phi) + \dfrac{1}{\sin(\theta + \phi)} + 1$

(B) $\sin(\theta - \phi) + \dfrac{1}{\cos(\theta + \phi)} + 1$

(C) $\cos(\theta + \phi) + \dfrac{1}{\sin(\theta - \phi)} + 1$

(D) $\cos(\theta + \phi) + \dfrac{1}{\cos(\theta - \phi)} + 1$

41. A rotary internal combustion engine has following number of cylinders :

(A) Seven

(B) Six

(C) Four

(D) Three

42. The purpose of link is to

(A) Transmit motion

(B) Guide links

(C) Provide support

(D) All of these

43. In any truncated conical pivot bearing, for uniform wear, the frictional torque transmitted is

(A) $\mu W \operatorname{cosec} \propto (r_1 + r_2)$

(B) $\frac{1}{2} \mu W \operatorname{cosec} \propto (r_1 + r_2)$

(C) $\mu W \operatorname{cosec} \propto (r_1 - r_2)$

(D) $\frac{1}{2} \mu W \operatorname{cosec} \propto (r_1 - r_2)$

44. The Coriolis is acceleration leads the sliding velocity by

(A) 45°

(B) 90°

(C) 135°

(D) 180°

45. For products subjected to large vibrations, which of the joint is better ?

(A) Threaded

(B) Hinged

(C) Welded

(D) Ball and socket

46. When a fastner is threaded into a tapped hole, it is called as

(A) Screw

(B) Bolt

(C) Washer

(D) Nut

47. Set screws can be subjected to

(A) Tensile load only.

(B) Compressive load only.

(C) Both tensile and compressive load.

(D) Neither tensile nor compressive load.

48. For a double threaded screw, nominal dia. and pitch are 100 mm and 12 mm respectively. The tangent of helix angle will be

(A) 0.021

(B) 0.041

(C) 0.061

(D) 0.081

49. For a velocity ratio requirement of 70 : 1, which type of gear is more suitable ?

(A) Spur

(B) Worm

(C) Helical

(D) Bevel

50. The section modulus of a circular plate of diameter, d, about an axis, through its centre of gravity, is

(A) $\frac{\pi d^3}{16}$

(B) $\frac{\pi d^4}{16}$

(C) $\frac{\pi d^3}{32}$

(D) $\frac{\pi d^4}{32}$

51. The property of any material due to which it can be rolled into plates is called

(A) Ductility

(B) Elasticity

(C) Malleability

(D) Plasticity

52. A 2 m long bar is extended by 2 mm under axial stress of 2 N/mm^2. The modulus of resilience is

(A) 0.01

(B) 0.02

(C) 0.10

(D) 0.20

53. What is the limiting value of Poisson's ratio ?

(A) 0 and 0.2

(B) 0 and 0.5

(C) 0.2 and 0.5

(D) 0.5 and 0.8

54. During bending of a beam, which layer remain unchanged ?

(A) Neutral Axis

(B) Load Axis

(C) Support Axis

(D) Rotational Axis

55. For a mild steel body of effective depth 400 mm, the depth of neutral axis is

(A) 172 mm

(B) 212 mm

(C) 272 mm

(D) 312 mm

56. The load at the end of a cantilever beam is increased. Probable failure may occur at

(A) middle

(B) end

(C) support

(D) anywhere

57. A steel rod of 40 mm diameter and 4 m length is subjected to an axial load of 80 kN. Calculate the elongation, if E = 200 GPa.

(A) 1.13 mm

(B) 1.23 mm

(C) 1.27 mm

(D) 1.33 mm

58. Which of the following is not an amorphous material ?

(A) Rubber

(B) Plastic

(C) Lead

(D) Glass

59. Normalising is best used for which material ?

(A) Low and medium carbon steel

(B) High Carbon Steel

(C) Cast Iron

(D) Steel wires and plates

60. For a BCC structure atomic packing factor is

(A) 0.54

(B) 0.64

(C) 0.68

(D) 0.74

61. Which one of the following factor is not related to quality of coke ?

(A) Moisture

(B) Ignitability

(C) Shape

(D) Conductivity

62. What does TRIP steel stands for ?

(A) Transformation Induced Plasticity

(B) Transformation Induced Property

(C) Transformation Induced Porosity

(D) Transformation Induced Pearlite

63. Fixture is used as a _____ used in the manufacturing industry.

(A) Work-holding or support device

(B) Tool-holding device

(C) Cutting tool

(D) Welding tool

64. In metal machining, the zone where the heat is generated due to friction between the moving chip and the tool face is called

(A) Friction zone

(B) Work-tool contact zone

(C) Shear zone

(D) None of (A), (B), (C)

65. Thrust force will increase with increase in

(A) Tool nose radius

(B) Cutting edge angle

(C) Rake angle

(D) End angle

66. The tool life can be enhanced by

(A) Increasing rake angle

(B) Decreasing rake angle

(C) Increasing side cutting rake angle

(D) Decreasing side cutting rake angle

67. Which of the following are moulding material defects ?

(A) Cut and Washes

(B) Fusion

(C) Metal Penetration

(D) All of these

68. Strength of the weld is due to diffusion and plastic deformation of the flying surface in

(A) Laser beam welding

(B) Ultrasonic welding

(C) Diffusion welding

(D) Gas welding

69. Under no load condition, voltage needed to generate the arc is termed as

(A) Short circuit voltage

(B) Open circuit voltage

(C) Closed circuit voltage

(D) Open arc voltage

70. During a machining process, chip velocity is 0.2 m/s with chip thickness ratio of 0.6. The cutting velocity is

(A) 0.23 m/s

(B) 0.28 m/s

(C) 0.33 m/s

(D) 0.38 m/s

71. When the molten metal is passed through an orifice, it breaks into pieces under high pressure fluid, the process is known as

(A) Crushing

(B) Electrolysis

(C) Reduction

(D) Atomization

72. The planning of material requirements, does not include

(A) Bill of material

(B) Inventory level

(C) Production schedule

(D) Material price

73. Elements of TQM does not include

(A) Customer focus

(B) Continuous improvement

(C) Intrinsic decision making

(D) Team leadership

74. In plant layout, greater flexibility is obtained in case of

(A) Process layout

(B) Product layout

(C) Fixed position layout

(D) Combination layout

75. Which of the following is independent of sales forecast ?

(A) Productivity

(B) Inventory control

(C) Production control

(D) Production plan

76. Which of the following time estimate is related to PERT ?

(A) One time estimate

(B) Two time estimate

(C) Three time estimate

(D) Four time estimate

77. The SIMPLEX method is used for

(A) Linear programming

(B) Value analysis

(C) Operation research

(D) Model analysis

78. Which one is not correct about critical ratio scheduling ?

(A) Determines the status of each activity.

(B) Establishes priorities among various activities.

(C) Determines status of each activity.

(D) Useful in automobile industry only.

79. If t_o is optimistic time, t_p is pessimistic time and t_n is most likely time, then the probabilistic time is given by

(A) $(4t_o + t_p + t_n)/6$

(B) $(t_o + 4t_p + t_n)/6$

(C) $(t_o + t_p + 4t_n)/6$

(D) $(t_o + t_p + t_n)/3$

80. A product can be produced by two methods. First have a fixed cost of 1500 and variable cost of 30. The second has a fixed cost of 2000 and variable cost of 20. The breakeven quantity between the two methods is

(A) 20

(B) 50

(C) 70

(D) 90

81. Queing theory is associated with

(A) Production time

(B) Waiting time

(C) Planning time

(D) Sales time

82. Which of following register of the processor is connected to memory Bus ?

(A) PC

(B) MAR

(C) RAM

(D) IR

83. A box that can represent two different condition in a flow chart.

(A) Circle

(B) Square

(C) Diamond

(D) Parallelogram

84. A flow chart that outlines the main segments of any program :

(A) Micro

(B) Queue

(C) Macro

(D) Union

85. An example of the delimiter in a FORTRAN program is

(A) Semi colon

(B) Double colon

(C) Single colon

(D) Comma

86. Which one is a valid variable declaration in FORTRAN ?

(A) Real : : Celcius

(B) Real Celcius

(C) Celcius Real

(D) Real : : Celcius

87. When the sleeve of a porter governer moves upwards, the governer speed

(A) Decreases

(B) Increases

(C) Remain constant

(D) First increases, then decreases

88. A taper provided on the pattern for its easy and clean withdrawal from the mould is known as

(A) Shrinkage allowance

(B) Distortion allowance

(C) Machining allowance

(D) Draft allowance

89. In order to balance the reciprocating masses

(A) Only primary forces and couples must be balanced.

(B) Only secondary forces and couples must be balanced.

(C) Both (A) and (B)

(D) None of (A), (B) or (C)

90. In high speed engines, the cam follower should move

(A) with uniform velocity.

(B) in cycloidal motion.

(C) in simple harmonic motion.

(D) in circular motion.

91. Screws used for power transmission should have

(A) fine threads

(B) strong teeth

(C) low efficiency

(D) high efficiency

92. A body is subjected to a direct tensile stress of 300 MPa in one plane accompanied by a simple shear stress of 200 MPa. The maximum shear stress will be

(A) 150 MPa

(B) 200 MPa

(C) 250 MPa

(D) 300 MPa

93. The energy stored in a body when strained within elastic limit is known as

(A) Strain energy

(B) Impact energy

(C) Resilience

(D) Elastic energy

94. Work done in a free expansion process is

(A) Positive

(B) Negative

(C) Zero

(D) Maximum

95. Carnot cycle efficiency is maximum when

(A) Initial temperature is 0 K

(B) Final temperature is 0 K

(C) Initial temperature is 0 °C

(D) Final temperature is 0 °C

96. A piston cylinder arrangement has air at 600 kPa, 290 K and volume of 0.01 m^3. During a constant pressure process, if it gives 54 kJ of work, the final volume must be

(A) 0.10 m^3

(B) 0.05 m^3

(C) 0.01 m^3

(D) 0.15 m^3

97. For a reversible process

(A) $ds = \frac{dQ}{T}$

(B) $ds < \frac{dQ}{T}$

(C) $ds > \frac{dQ}{T}$

(D) $ds \geq \frac{dQ}{T}$

98. Flow work is analogous to

(A) Stirring work

(B) Electrical work

(C) Displacement work

(D) Shaft work

99. Which one of the following represents the energy in storage ?

(A) Work

(B) Heat

(C) Energy

(D) Internal energy

100. The short coming of first law of thermodynamics is

(A) Direction of process

(B) Possibility of process

(C) Quality of energy

(D) Quantity of energy